TM 11-6110-245-15

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT GENERAL SUPPORT, AND DEPOT MAINTENANCE MANUAL

VOLTAGE REGULATOR CN-514/GRC

This copy is a reprint which includes current pages from Changes 1 and 2.

HEADQUARTERS, DEPARTMENT OF THE ARMY

FEBRUARY 1969

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

DON'T TAKE CHANCES

Be careful not to contact the high-voltage circuits and the 115-volt ac input circuits. Serious injury or DEATH may occur.

Before making test connections, changing tubes, or removing subassemblies always turn off the ac power.

TECHNICAL MANUAL
No. 11-6110-245-15

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C. *26 February 1969*

Operator, Organizational, Direct Support, General Support, and Depot Maintenance Manual
VOLTAGE REGULATOR CN-514/GRC

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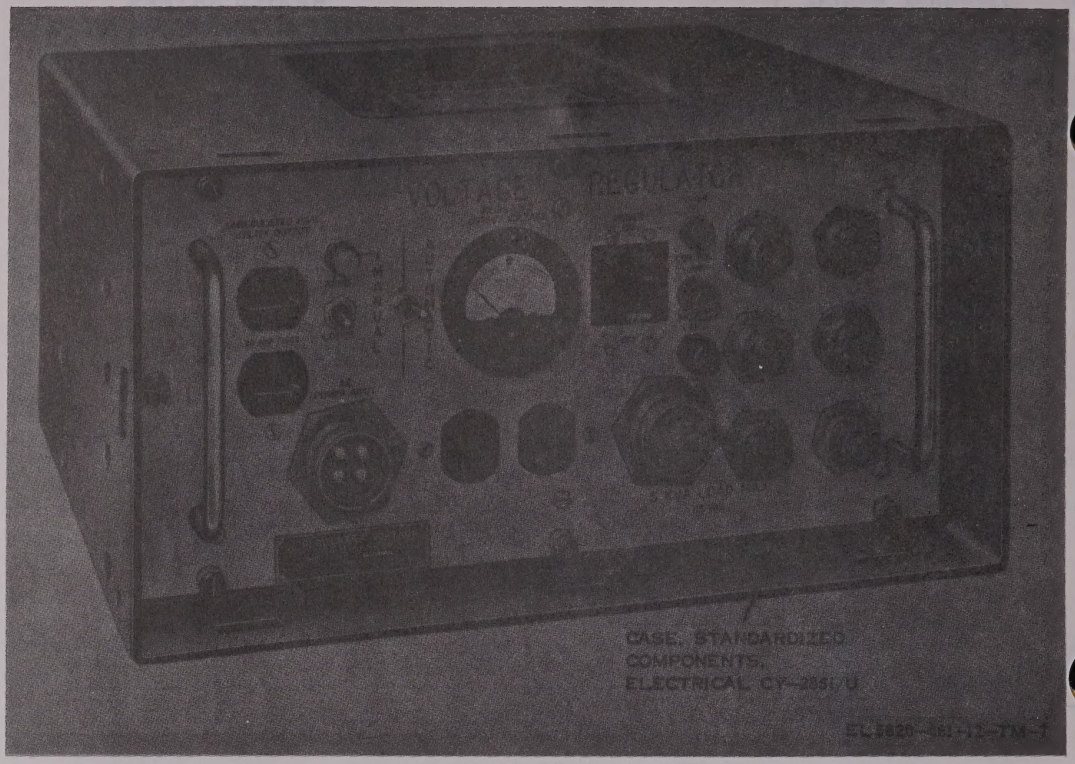


Figure 1–1. Voltage Regulator CN–514/GRC.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1-1. Scope

a. This manual describes Voltage Regulator CN-514/GRC and covers its installation, operation, functioning, and maintenance.

b. Appendix A contains a list of publications applicable to the equipment, and appendix C contains the maintenance allocation chart.

c. Appendix C is current as of 6 July 1973.

1-2. Indexes of Publications

a. DA Pam 310-4. Refer to DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA Pam 31-7. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

1-3. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Packaging Improvement Report) as prescribed in AR 700-58/NAVSUPINST 4030.29/AFR 71-13/MCO P4030.29A, and DSAR 4145-8.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33A/AFR 75-18/MCO P4610.19B, and DSAR 4500.15.

1-3.1. Reporting of Equipment Publication Improvements

The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications and Blank Forms), and forwarded direct to Commander, US Army Electronics Command, ATTN: DRSEL-MA-Q, Fort Monmouth, NJ 07703.

Section II. DESCRIPTION AND DATA

1-4. Purpose and Use

a. The CN-514/GRC may be used with unregulated alternating current (ac) supply voltages in the range of 95 to 135 volts ac, 47.5 to 63.5 cycles per second (cps), and provides a regulated 115-volt ac output rated at 43 amperes (maximum).

b. The CN-514/GRC may be used with electrical equipment installations where a regulated 115-volt ac source is required.

1-5. Technical Characteristics

Capacity ..... 5 kva.
Efficiency ..... Better than 98 percent.
Input:
  Voltage ..... 95 to 135 vac.
  Frequency ..... 47.5 to 63.5 cps.
Output:
  Automatic regulation ..... 115 vac ± 1 percent.
  Current ..... 0 to 43 amperes.
Weight ..... 89.24 pounds.

1-6. Components and Running Spares

a. Items Comprising an Operable Voltage Regulator CN-514/GRC.

FSN	*QTY*	*Nomenclature, part No., and mfr code*	*Fig. No.*
		NOTE The part number is followed by the applicable 5-digit Federal supply code for manufacturers (FSCM) identified in SB 708-42 and used to identify manufacturer, distributor, or Government agency, etc.	
		Regulator, Voltage CN-514/GRC (This item is nonexpendable) including:	1-1
5975-959-3366	1	Case, Standardized Components, Electrical CL-2851/U.*	1-1

*CY-2851/U includes a cover (not shown in figure 1-1). In some communication configurations in which the CN/514/U is used, the CY-2851/U is not provided.

b. Running Spares. The following items are stowed inside the CN-514/GRC (fig. 5-2).

Item	*Federal stock No.*
Fuse, cartridge: 20 amp (1 ea)	5920-557-6057
Fuse, cartridge: 1 amp (1 ea)	5920-665-2881
Electron tube: 5727/2D21W (1 ea)	5960-284-9285

1-7. Description of Voltage Regulator CN-514/GRC

(fig. 1-1)

The CN-514/GRC is housed in Case, Standardized Components, Electrical CY-2851/G (case) that may be used for carrying and stack mounting. The CN-514/GRC is used to regulate and distribute the primary power source for certain radio sets and communication equipments. All controls and power connections are located on the front panel. A front panel meter indicates the regulated output voltage applied to the associated equipments.

1-8. Differences in Models

Later-manufactured voltage Regulators CN-514/GRC use a larger sprocket gear in the chain drive system (fig. 5-1). The later-manufactured sets have CAUTION: OUTPUT VOLTAGE SHOULD NOT BE ADJUSTED TO EXCEED 115 VOLTS stenciled on the front panel.

CHAPTER 2

INSTALLATION

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

2-1. Unpacking
(fig. 2-1)

a. Packaging Data. When packed for shipment, the CN-514/GRC is placed in a carton and packed in a wooden box. A typical packing case and its contents are shown in figure 2-1. The packaging data is listed below:

(1) Height: 9 in.

(2) Width: 18 in.

(3) Depth: 17 in.

(4) Volume: 1.59 cu ft.

(5) Weight: 109 lb.

b. Component Dimensions.

Component	Overall dimensions (in.) Height	Width	Depth	Volume (cu ft)	Weight (lb)
Regulator, Voltage CN-514/GRC (less case).	7-3/4	16	14	1	89.25
Case, Standardized Components, Electrical CY-2851/G.	8-1/2	17	15	1.4	15.75

c. Removal of Contents. Unpack the equipment as follows:

(1) Select a location that is convenient to the installation of the equipment and where the equipment may be unpacked without exposure to bad weather.

(2) Cut and fold back the metal straps around the wooden packing box. Use a pair of tin snips, or a large pair of diagonal-cutting pliers.

***Caution:* Do not attempt to pry off the wooden cover of the box without removing the nails; the equipment may become damaged.**

(3) Remove the nails from the wooden cover with a nailpuller. Remove the wooden cover.

(4) Lift out the moistureproof barrier that contains the outer carton.

(5) Remove the gum seal on the moistureproof barrier and remove the outer carton.

(6) Open the carton and remove the moisture-vaporproof barrier that contains the inner carton; remove the inner carton. Open the inner carton and remove the contents.

2-2. Checking Unpacked Equipment

a. Inspect the equipment for damage that may have occurred during shipment. If the equipment has been damaged, fill out and forward DD Form 6 (para 1-3*b*).

b. Check to see that the equipment is complete as listed on the packing slip. If a packing slip is not available, check the equipment against the components list (para 1-6). Report all discrepancies in accordance with paragraph 1-3*c*. The equipment should be placed in service even though a minor assembly or part that does not affect proper functioning is missing.

c. Check to see whether the equipment has been modified. If the equipment has been modified, the MWO number will appear on the front panel, near the nomenclature plate. Check also to see whether all MWO's current at the time the equipment is placed in use have been applied.

Note. Current MWO's applicable to the equipment are listed in DA Pam 310-7.

d. Check the latest issue of DA Pam 310-4 and its latest changes to see whether you have the latest editions of all applicable maintenance literature. (Equipment issued by depots may have been in stock for some time and may contain superseded manuals.)

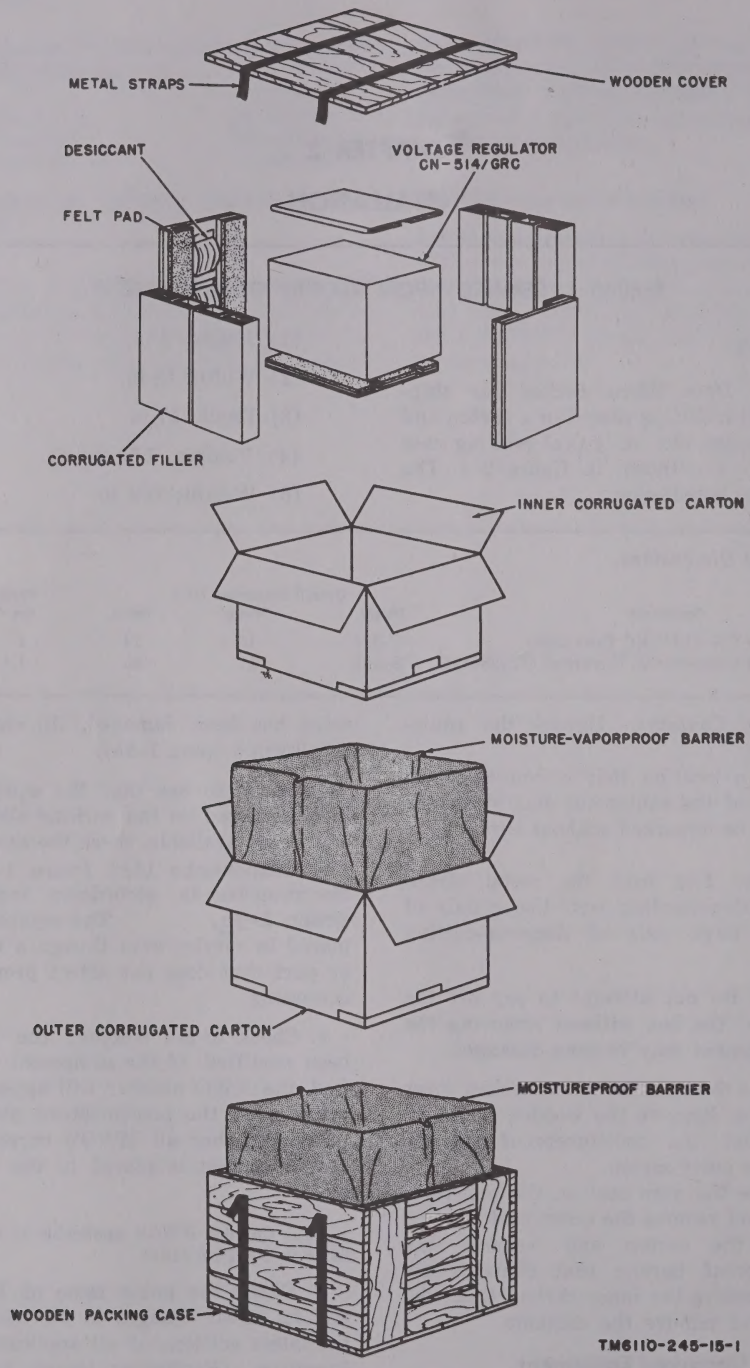


Figure 2-1. Typical packaging.

Section II. INSTALLATION INSTRUCTIONS

2-3. Initial Adjustments
(fig. 3-1)

With a nonmetallic screwdriver, adjust REGULATED OUTPUT VOLTAGE Meter M1 for a zero indication. No other adjustments are to be made at this time.

2-4. Installation of Equipment

No special siting or mounting instructions are required since the unit may be stacked or self-mounted. For installation instructions, refer to the technical manual for the equipment with which the CN-514/GRC is being used.

CHAPTER 3

OPERATING INSTRUCTIONS

3-1. Operating Controls, Indicators, and Connectors (fig. 3-1)

Operating controls, indicators, and connectors are described in the chart below:

Control, indicator, or connector	Function	
	Sw position	Action
MANUAL-AUTOMATIC switch	MANUAL	Permits output voltage to be controlled by RAISE-LOWER switch.
	AUTOMATIC	Output voltage automatically held at 115 volts.
MANUAL indicator		When lighted, indicates MANUAL-AUTOMATIC switch in MANUAL position.
RAISE-LOWER switch		Controls output voltage when MANUAL-AUTOMATIC switch is set to MANUAL.
REGULATED OUTPUT VOLTAGE meter M1		Indicates regulated output voltage.
POWER ON-OFF switch		Turns CN-514/GRC ac power on and off. Also serves as circuit breaker to automatically turn ac power off if overload occurs.
POWER ON indicator		When lighted, indicates POWER ON-OFF switch is set to ON
AC POWER INPUT connector		Connection for unregulated ac input voltage supply.
UNREGULATED 115 V UTILITY OUTPUT connectors		Local convenience outlets for ac input voltage supply.
5 KVA LOAD MAX-115 VAC connectors		Connections for regulated ac output voltage supply. Maximum total loading for connectors is 5 kva.

3-2. Preliminary Starting Procedure (fig. 3-1)

a. Set the POWER switch to OFF.

b. Check to see that all cabling is properly installed, refer to the technical manual for the equipment with which the CN-514/GRC is being used.

3-3. Initial Adjustments

Adjust the output of the CN-514/GRC as follows:

a. Set the POWER ON-OFF switch to ON.

b. Set the MANUAL-AUTOMATIC switch to MANUAL.

c. Set the RAISE-LOWER switch until the REGULATED OUTPUT VOLTAGE meter indicates 115 volts ac.

Caution: **Do not adjust the output voltage above 115 volts; output voltages above 115 volts will damage equipment used with CN-514/GRC.**

d. Set the MANUAL-AUTOMATIC switch to AUTOMATIC; REGULATED OUTPUT VOLTAGE meter should indicate 115 volts ac.

e. Set the POWER ON-OFF switch to OFF.

3-4. Operating Procedure

Once the initial adjustments have been made (para 3-3) the CN-514/GRC is operational. To start the CN-514/GRC, set the POWER ON-OFF switch to ON.

3-5. Stopping Procedure (fig. 3-1)

To stop the CN-514/GRC, set the POWER ON-OFF switch to OFF. Note that the POWER ON indicator light extinguishes.

3-6. Operation Under Unusual Conditions

Two situations can occur that will require deviations from the normal operating procedure:

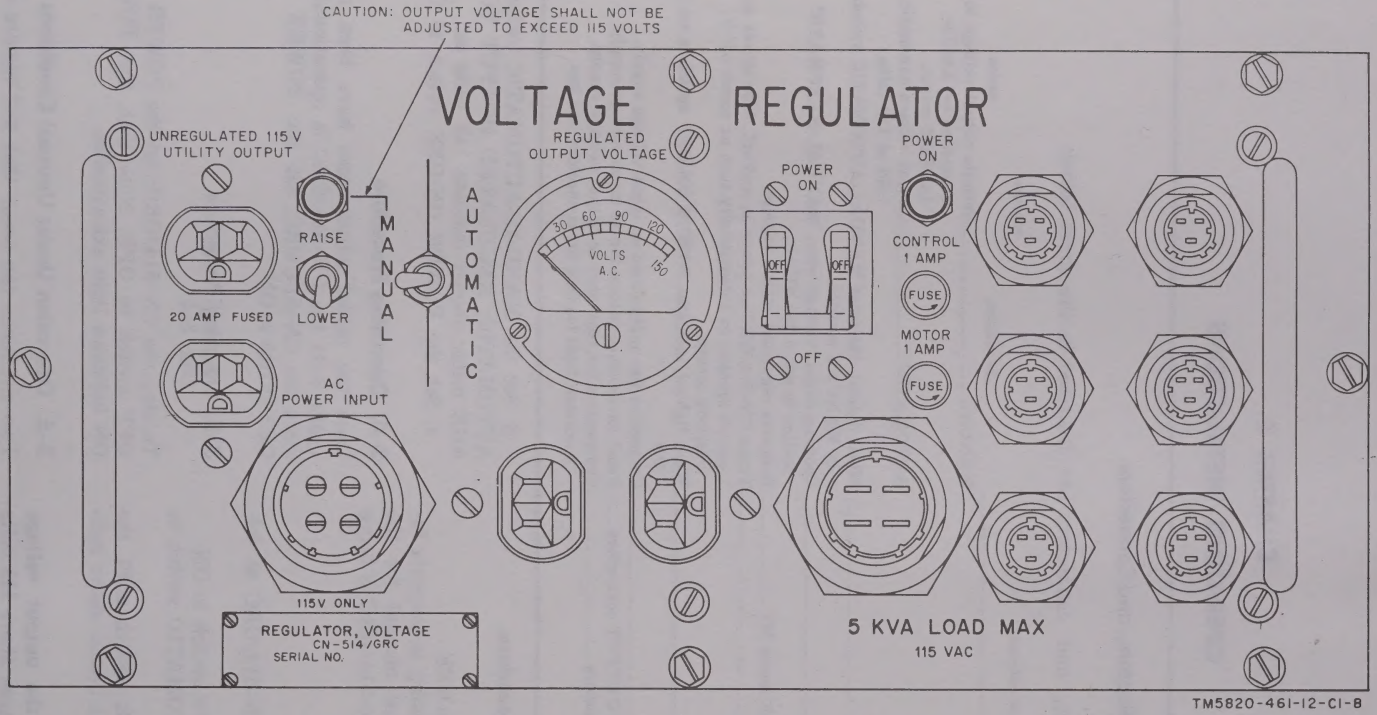


Figure 3-1. Voltage Regulator CN-514/GRC, front panel view.

a. Failure of Automatic Regulation Circuits. If this action occurs, as shown by a loss of regulation or a significant change in regulated output voltage, set the MANUAL-AUTOMATIC switch to MANUAL and operate the RAISE-LOWER switch as needed to insure that correct supply voltages are maintained. Check the REGULATED OUTPUT VOLTAGE meter indication frequently.

b. Requirement for Lower Unregulated Output Voltage. At times, a requirement may exist for unregulated output supply voltages in the range of 110 to 115 volts ac. These voltages can be obtained by setting the MANUAL-AUTOMATIC SWITCH to MANUAL and moving the RAISE-LOWER SWITCH as needed to obtain the desired unregulated output voltage, as indicated on the REGULATED OUTPUT VOLTAGE meter.

CHAPTER 4

OPERATOR'S MAINTENANCE

4-1. Scope of Operator's Maintenance

a. The maintenance duties listed below are normally performed by the operator of the CN-514/GRC and do not require special tools or test equipment.

b. Operator's maintenance for the CN-514/GRC consists of the following:

(1) Preventive maintenance (paras 4-2 through 4-5).

(2) Visual inspection (para 4-6).

(3) Troubleshooting chart (para 4-7).

(4) Replacement of indicator lamps (para 4-8).

(5) Replacement of fuses (para 4-9).

4-2. Operator's Preventive Maintenance

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, reduce downtime, and assure that the equipment is serviceable.

a. Systematic Care. The procedures given in paragraphs 4-3 through 4-6 cover routine systematic care and cleaning essential to the proper upkeep and operation of the equipment.

b. Preventive Maintenance Checks and Services. The preventive maintenance checks and services charts (paras 4-4 and 4-5) outline functions to be performed at specific intervals. These checks and services are to maintain Army electronic equipment in a combat-serviceable condition; that is in good general (physical) condition and in good operating condition. To assist the operator in maintaining combat serviceability, the charts indicate what to check, how to check, and the normal conditions; the *References* column lists the illustration, paragraph, or manual that contains supplementary information. If the defect cannot be remedied by the operator, higher category maintenance or repair is required. Records and reports of these checks and services must be made in accordance with the requirements set forth in TM 38-750.

4-3. Operator's Preventive Maintenance Checks and Services Periods

Preventive maintenance checks and services are required daily. Paragraph 4-4 specifies the items to be inspected and serviced. In addition to daily checks, the equipment should be reinspected and serviced immediately before going on a mission and as soon after the completion of the mission as possible. If the equipment is kept in a standby condition, the checks and services given in paragraph 4-4 should be performed each week.

4-4. Operator's Daily Preventive Maintenance Checks and Services Chart

Sequence No.	Item to be inspected	Procedure	References
1	Exterior surfaces	Clean all exterior surfaces	Para 4-5.
2	Connections	Make sure that all cables are making good contact in correct receptacle. ***Caution*: Disconnect input power while checking connections.**	Fig. 3-1.
3	Switches	While operating (item 4 below), observe that mechanical action of each switch is smooth and free of external or internal binding.	Fig. 3-1.
4	Operation	Perform operating procedures	Paras 3-2 and 3-3.

4-5. Cleaning

The exteriors of the CN-514/GRC should be free of dust, dirt, grease and fungus.

a. Remove dust and loose dirt with a clean, soft cloth.

***Warning:* Prolonged breathing of cleaning compound is dangerous; make sure that adequate ventilation is provided. Cleaning compound is flammable. Do not use near a flame. Avoid contact with the skin; wash off any that spills on the hands.**

b. Remove grease, fungus and ground-in dirt from the case; use a cloth dampened (not wet) with the cleaning compound (FSN 7930-395-9542).

c. Remove dust or dirt from plugs and jacks with a brush.

Caution: **Do not press on the meter face (glass) when cleaning; the meter may become damaged.**

d. Clean the front panel, the meter, and the controls; use a soft, clean cloth. If difficulty in removing dirt occurs, dampen the cloth with water; mild soap may be used to make the cleaning more effective.

4-6. Visual Inspection

a. When the equipment fails to perform properly, turn off the power and check all the items listed below. *Do not check any item with the power on.*

(1) Wrong switch settings.

(2) Defective cabling or connections.

b. If the checks given in (1) and (2) above do not locate the trouble, proceed to the troubleshooting chart (para 4-7).

4-7. Operator's Troubleshooting Chart

a. General. The checks and corrective measures listed in the troubleshooting chart (*c* below) can be performed by the operator. When no corrective measures are listed, or if the measures suggested to not restore normal equipment performance, *troubleshooting is required by higher category maintenance personnel.* Note on the repair tag what corrective measures were taken and how the equipment performed at the time of failure.

b. Procedure. To check the equipment, note the trouble symptoms and perform the corrective measures listed in the chart (*c* below) in sequence. Do not proceed until an abnormal condition is corrected. Before proceeding with the troubleshooting chart, make sure that the equipment is shut down completely.

c. Troubleshooting Chart (fig. 3-1).

Item No.	Trouble symptom	Probable trouble	Checks and corrective measures
1	POWER ON indicator does not light.	Improper cable connections	Check cable connections.
		Defective POWER ON indicator lamp	Replace POWER ON indicator lamp. (para 4-8).
2	MANUAL indicator does not light when MANUAL-AUTOMATIC switch is set to MANUAL.	Defective MANUAL indicator lamp	Replace MANUAL indicator lamp. (para 4-8).
3	REGULATED OUTPUT VOLTAGE meter indication does not raise and lower when RAISE-LOWER switch is set to RAISE and LOWER.	Defective MOTOR 1 AMP fuse	Replace MOTOR 1 AMP fuse (para 4-9).
4	REGULATED OUTPUT VOLTAGE meter does not indicate 115 volts ac when MANUAL-AUTOMATIC switch is set to AUTOMATIC.	Defective CONTROL 1 AMP fuse	Replace CONTROL 1 AMP fuse (para 4-9).

4-8. Replacement of Indicator Lamps (fig. 3-1)

Replace an indicator lamp as follows:

a. Turn the lampholder counterclockwise.

b. Remove the lampholder from its receptacle.

c. Remove the defective lamp from the lampholder.

d. Insert the replacement lamp in the lampholder.

e. Replace the lampholder in its receptacle and tighten the lampholder by turning it clockwise.

4-9. Replacement of Fuses (fig. 3-1)

a. The fuses listed below can be replaced by the operator.

(1) MOTOR 1 AMP.

(2) CONTROL 1 AMP.

b. Replace a fuse as follows:

(1) Turn the fuseholder counterclockwise.

(2) Remove the fuseholder from its receptacle.

(3) Remove the defective fuse from the fuseholder.

(4) Insert the replacement fuse in the fuseholder.

(5) Replace the fuseholder in its receptacle and tighten the fuseholder by turning it clockwise.

CHAPTER 5

ORGANIZATIONAL MAINTENANCE

5-1. Scope of Organizational Maintenance

Organizational maintenance of the CN-514/GRC includes:

a. Preventive maintenance (paras 5-2 through 5-7).

b. Troubleshooting (paras 5-8, 5-9, and 5-10).

c. Repairs (para 5-11).

5-2. Tools, Materials, and Test Equipment Required

The materials, tools, and test equipment required for organizational maintenance are listed below.

a. Tools. Tool Kit, Radio Repairman TK-101/G.

b. Materials.

(1) Cleaning compound (FSN: 7390-395-9542).

(2) Cleaning cloth.

(3) Sandpaper, No. 000.

(4) Grease, Aircraft and Instrument (GL) (FSN: 9150-190-0899).

c. Test Equipment. Multimeter AN/URM-105.

5-3. Organizational Preventive Maintenance

a. Preventive maintenance is the systematic care, inspection, and servicing of the equipment to maintain it in serviceable condition, prevent breakdown and insure maximum operational capability. Preventive maintenance is the responsibility of all maintenance categories concerned with the equipment, and includes the inspection, testing, and repair or replacement of parts, subassemblies, or units that checks and services indicate would probably fail before the next scheduled periodic service. Preventive maintenance checks and services of the CN-514/GRC at the organizational category are made quarterly, unless otherwise directed by the commanding officer.

b. Maintenance forms and records to be used and maintained on this equipment are specified in TM 38-750.

5-4. Organizational Quarterly Maintenance

Quarterly maintenance on the CN-514/GRC will be scheduled in accordance with the requirements of TM 38-750. All deficiencies or shortcomings will be recorded, and those not corrected during the checks and services will be immediately reported to a higher category of maintenance in accordance with procedures specified in TM 38-750. Equipment that has a deficiency that cannot be corrected by organizational personnel should be deadlined in accordance with instructions given in TM 38-750. Perform all the procedures listed in the quarterly preventive maintenance checks and services chart (para 5-5) in the sequence listed. Whenever an abnormal condition is observed, take corrective action in accordance with the paragraph or figure listed in the *References* column, or refer the equipment to a higher category of maintenance.

5-5. Organizational Quarterly Preventive Maintenance Checks and Services Chart

Sequence No.	Item to be inspected	Procedure	References
1	Completeness	Check to see that equipment is complete.	App B.
2	Installation	Check to see that CN-514/GRC is properly installed.	Paras 2-3 and 2-4.
3	Cleanliness	Check to see that equipment is clean	Para 5-6.
4	Preservation	Check all surfaces for evidence of fungus. Remove rust and corrosion and spotpaint bare spots.	Para 5-6*d*.

Sequence No.	Item to be inspected	Procedure	References
5	Publications	Check to see that all publications are complete, serviceable and current.	DA Pam 310-4.
6	Modifications	Check DA Pam 310-7 to determine if new applicable MWO's have been published. All URGENT MWO's must be applied immediately. ALL ROUTINE MWO's must be scheduled.	DA Pam 310-7 and TM 38-750.
7	Lubrication	Lubricate the CN-514/GRC as instructed in paragraph 5-7.	Para 5-7.
8	Pluckout items	Inspect for seating of pluckout items. Check for wrong or broken parts.	Fig. 5-2.
9	Fuses	Check to see that all fuses are of correct value. Check spare fuses for proper value and quantity.	App B.

5-6. Additional Maintenance Items

a. Chain Linkage (fig. 5-1). Inspect the chain linkage for dirt, rust, corrosion, or loose and worn links. Remove dirt with a cleaning cloth dipped in the cleaning compound. Remove rust or corrosion with fine sandpaper. If any sanding is performed, wipe abraded area thoroughly with a cleaning cloth dipped in cleaning compound; then coat the area lightly with grease (GL). If links are loose or worn excessively, higher category maintenance is required.

Warning: **Prolonged breathing of cleaning compound is dangerous; make sure adequate ventilation is provided. Cleaning compound is flammable; do not use near a flame. Avoid contact with the skin; wash off any that spills on the hands.**

b. Gears and Shafts (fig. 5-1). Check the gears and shafts for dirt, rust, or corrosion and evidence of wear. If the gears or shafts are excessively worn, higher category maintenance is required.

c. Cleaning. Clean the CN-514/GRC as follows:

Warning: **Prolonged breathing of cleaning compound is dangerous; make sure adequate ventilation is provided. Cleaning compound is flammable; do not use near a flame. Avoid contact with the skin; wash off any that spills on the hands.**

(1) Remove dirt from the terminal blocks and the connectors with a cleaning cloth moistened with the cleaning compound.

(2) Use a cleaning cloth dipped in the cleaning compound to remove the dirt and dust from the exterior surfaces.

d. Painting. Remove rust and corrosion from metal surfaces by lightly brushing them with sandpaper. Brush two thin coats of paint on the bare metal to protect it from further corrosion. Refer to applicable cleaning and refinishing procedures given in TB SIG 364.

5-7. Lubrication

a. In figure 5-1, which shows the lubrication points of the CN-514/GRC, *Q* represents a period of 3 months. A 3-month interval consists of 90 days of normal 8-hour-per-day operation. If the equipment is operated more than 8 hours a day, the lubrication inspection intervals should be adjusted to prevent active wear. For example, if the equipment is operated 16 hours a day instead of 8, inspection for lubrication will be necessary, and new lubrication applied as required every 45 days instead of every 90 days.

b. Loosen the mounting screws that attach the CN-514/GRC to the component case and remove the unit from the component case. Clean the sprockets and the chain with a brush dipped in the cleaning compound (fig. 5-1). Apply a light film of grease (GL) to the sprockets and chain with a clean brush.

5-8. General Troubleshooting Instructions

a. The organizational troubleshooting procedures begin with the operational checks given in the operator's daily preventive maintenance checks and services chart (para 4-4) and the operator's troubleshooting chart (para 4-7).

b. There are three positive indications of trouble in the CN-514/GRC that require repair or adjustment procedures at the organizational category:

(1) Power ON-OFF switch CB1 trips to OFF.

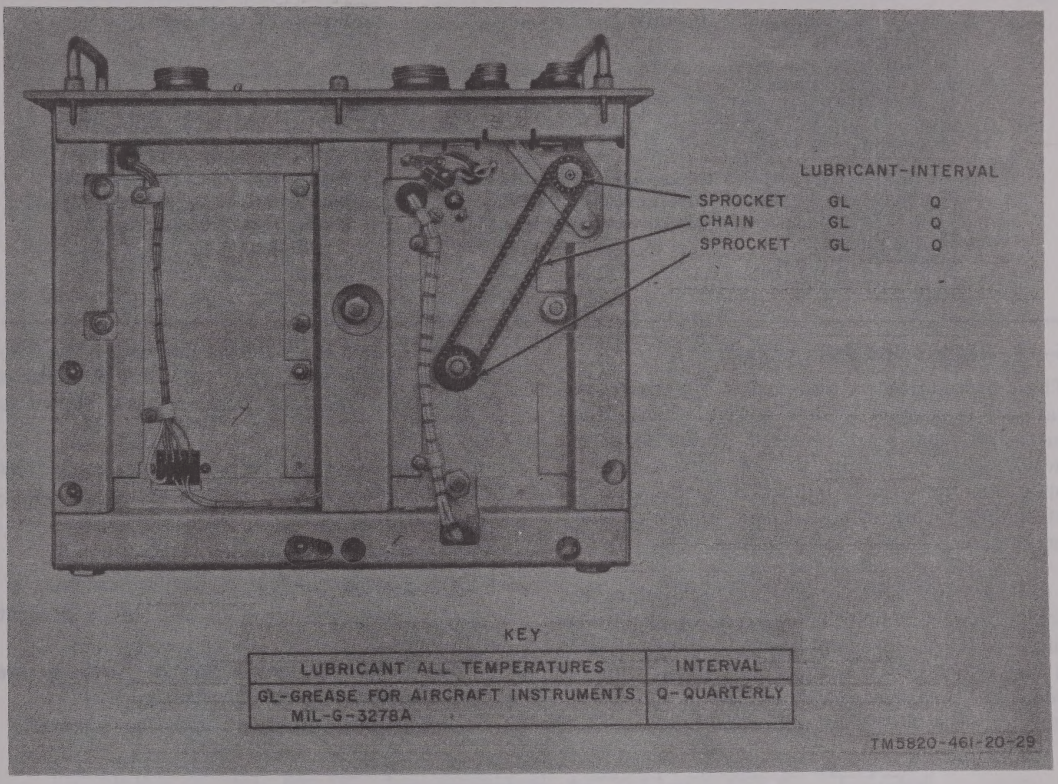


Figure 5–1. Voltage Regulator CN–514/GRC, lubrication points.

(2) Front-panel indicators remain off.

(3) REGULATED OUTPUT VOLTAGE meter does not indicate 115 volts ac.

5–9. Visual Inspection

Caution: **Turn off all power before proceeding with the visual inspection.**

When equipment failure occurs, inspect the equipment carefully before performing detailed troubleshooting procedures. This will save time and may also avoid further damage to the equipment. Loosen the captive screws that hold the chassis to the component case. Remove the chassis from the component case and inspect it for the defects listed below.

a. Improperly seated assemblies.

b. Worn, broken, or disconnected cords or connectors.

c. Improperly connected cords or connectors.

d. Broken wires or parts because of strain or excessive vibration.

e. Broken or cracked tubes.

f. Defective operation of switches and controls.

g. Discolored or blistered resistors, capacitors, and silicon rectifiers.

5–10. Organizational Troubleshooting Chart

Troubleshooting of the CN–514/GRC is based on the operational checks (para 4–7) and the quarterly preventive maintenance checks and services chart (para 5–5). When an abnormal condition or result is obtained, perform the checks and corrective measures indicated in the troubleshooting chart. Paragraph 5–11 contains additional instructions for performing maintenance during troubleshooting procedures.

Item No.	Trouble symptom	Probable trouble	Checks and corrective measures
1	MANUAL lamp lights, but operating RAISE LOWER switch will not change output voltage when AUTOMATIC-MANUAL switch is set to MANUAL.	Defective fuse F3	Replace F3 (para 4-9).
2	REGULATED OUTPUT VOLTAGE meter does not indicate 115 volts when MANUAL-AUTOMATIC switch is set to AUTOMATIC.	Defective fuse F3 or F4 Defective tube V1 or V2 Defective regulator assembly 1A1	Replace fuse F3 or F4 (para 4-9). Replace tube V1 or V2 (para 5-11*a*). Replace regulator assembly 1A1 (para 5-11*b*).

5-11. Repairs and Adjustments

These procedures are designed to aid the organizational repairman in determining when adjustments or repairs are required. If the suggested adjustments or repairs do not restore normal operation, or normal indication is not obtained after test, repair, or adjustment, higher category maintenance repairs are required.

a. Tube Replacement Procedures.

(1) When trouble occurs, check all cables, connections, and fuses before removing and testing any tubes. Attempt to isolate the trouble to a component or assembly. When tube failure is suspected, use the procedures given in (2) below to reach the tubes.

(2) Loosen the 8 screws that attach the CN-514/GRC in the case, (fig. 1-1), and slide it out of the case. The tube locations are shown in figure 5-2.

b. Replacement of Regulator Assembly 1A1 (fig 5-2). Remove and replace regulator assembly 1A1 as follows:

(1) Remove any interconnecting cables.

(2) Loosen the four mounting screws.

(3) Grasp the assembly and pull it straight up and out.

(4) Insert the new assembly. Check to see that the assembly is seated correctly.

(5) Tighten the four mounting screws.

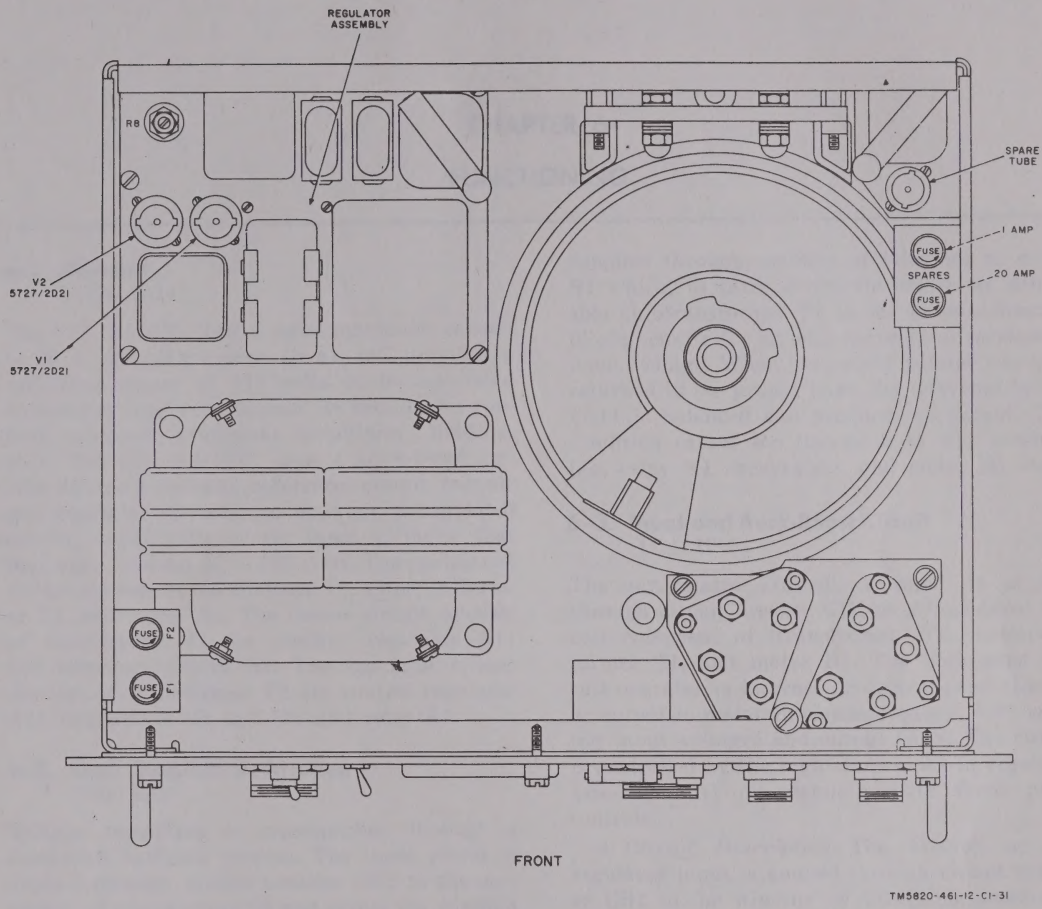


Figure 5-2. Tube and regulator assembly locations.

CHAPTER 6

FUNCTIONING

6-1. General
(fig. 6-1)

The CN-514/GRC has a rated maximum capacity of 5 kilovolt-amperes (kva) and provides a regulated output of 115 volts ac to associated equipment (load). Additional ac receptacles connect auxiliary equipment (multiplex, lighting, etc). The CN-514/GRC uses a buck-boost circuit and an automatic reference circuit (sensor and regulator circuits) to maintain a regulated output of 115 volts ac for input voltages that may vary between 95 to 135 volts. The buck-boost circuit consists of transformer T2, autotransformer T1, and motor B1. The sensor circuit consists of transformer T1 (in control regulator A1) and reference bridge A1. The regulator circuit consists of transformer T2 (in control regulator A1), thyratrons V1 and V2, and relay K1.

6-2. Block Diagram Description
(fig. 6-1)

Voltage regulation is accomplished through a controlled feedback process. The input power is applied through circuit breaker CB1 to the secondary of transformer T2 and across the winding of adjustable autotransformer T1. Autotransformer T1 governs the primary voltage of transformer T2 by a slider, which is controlled (driven) by motor B1. This primary voltage, in turn, determines the amplitude of the output voltage. Motor B1 is energized from control regulator A1. The output voltage of transformer T1 (in control regulator A1) is applied to reference bridge A1. The output of A1 is applied to the primary of transformer T2 (in control regulator A1); the secondary of T2 is connected to the grids of thyratrons V1 and V2 and, depending on the output of reference bridge A1, will cause either V1 or V2 to conduct. When the bridge is balanced (output voltage at a nominal 115 volts ac), no voltage is applied to T2; therefore, neither V1 nor V2 will conduct. When V1 or V2 conducts, bipolar relay K1 is energized; the particular side of relay K1 which conducts depends on the conducting thyratron. Power is then supplied through contacts of relay K1 to motor B1 which, in turn, drives the slider on adjustable autotransformer T1 in the proper direction to compensate for either a decrease or increase in input voltage. When the output voltage has been returned to the proper level, the reference bridge (A1) is balanced and produces no output. This condition causes the thyratron to stop conducting, relay K1 deenergizes, and motor B1 stops.

6-3. Input and Buck-Boost Circuit
(fig. 10-3)

The unregulated 115-volt ac input is applied through circuit breaker CB1 to a buck-boost circuit composed of transformer T2, autotransformer T1, and motor B1. The buck-boost circuit operates to increase or decrease the 115-volt ac output to maintain constant output with varying input voltages and output loads. The circuit is controlled by the regulator circuit in regulator assembly 1A1 or manually with front panel controls.

a. Circuit Description. The 115-volt ac unregulated input is applied through circuit breaker CB1 to the winding of adjustable autotransformer T1 and the secondary winding of transformer T2, terminals 3 and 4. One side of the primary of transformer T2 is connected to a tap (pin 3) on T1; the other side is connected to the slider arm (pin 4) of T1, which is operated by motor B1. When the slider is moved above the tap to which T2 is connected, a voltage is placed on the primary of transformer T2 in such a direction as to add (boost), by transformer action, to the voltage which is present at the secondary of T2. When the slider is moved below the tap, the voltage subtracts (bucks) from the line voltage present at the secondary of T2. By slider action, the 115-volt regulated output voltage may be varied ±20 volts to a predetermined level.

b. Component Functions. The functions of component parts associated with the operation of the input and buck-boost circuit, not described in *a* above, are listed in the chart below:

Component	Function
F1 and F2	Provide protection for UNREGULATED 115/VH UTILITY OUTPUT connector J2.
F3	Provides protection for windings of motor B1.
F4	Protects regulator circuit.
S1	Switches control of motor B1 from output of regulator circuit to manual operation.
S2	Manually controls operation of motor B1.
DS1	Indicates when switch S2 is set to MANUAL.
DS2	Indicates when POWER ON-OFF switch CB1 is set to ON and input voltage is applied to equipment.
M1	Provides visual indication of voltage output.

6-4. Sensor Circuit (fig. 10-3)

The sensor circuit, located in regulator assembly 1A1, consists of transformers T1 and T2, resistor R2, and plug-in assembly A1. The sensor circuit detects changes in the 115-volt regulated output line. The center-tapped secondary winding of T1, resistors R1 and R3, and ballast resistor R2 in A1 form a bridge circuit, with transformer T2 connected across the output terminals of the bridge as a detector. Potentiometer R2 and resistor R1, in parallel, permit a precise setting of a balance point for a given voltage of approximately 115 volts nominal for the regulated output. When the output voltage drops, the voltage on the primary of T1 drops, decreasing the secondary voltage of T1 which is across the bridge circuit. This reduction in voltage causes a reduction in current through the bridge circuit, allowing ballast resistor R2 to cool and decrease its resistance. This decreased resistance of R2 unbalances the bridge, causing current to flow through the primary of transformer T2. This action develops a voltage across the secondary of T2 in proportion to the decreased output voltage. An increase in voltage will produce the opposite effect.

6-5. Regulator Circuit (fig. 10-3)

When a variation in regulated output voltage is detected by the sensor circuit (para 6-4), an input is applied to the regulator circuit. The regulator circuit consists of transformer T2, thyratrons V1 and V2, and relay K1. Operation of motor B1 in the voltage regulator is controlled by the output of the regulator circuit.

a. Circuit Operation.

(1) When the input voltage is lower than 115 volts, the reference bridge of the sensor circuit becomes unbalanced. A voltage appears across the secondary of T2 to make the grid of

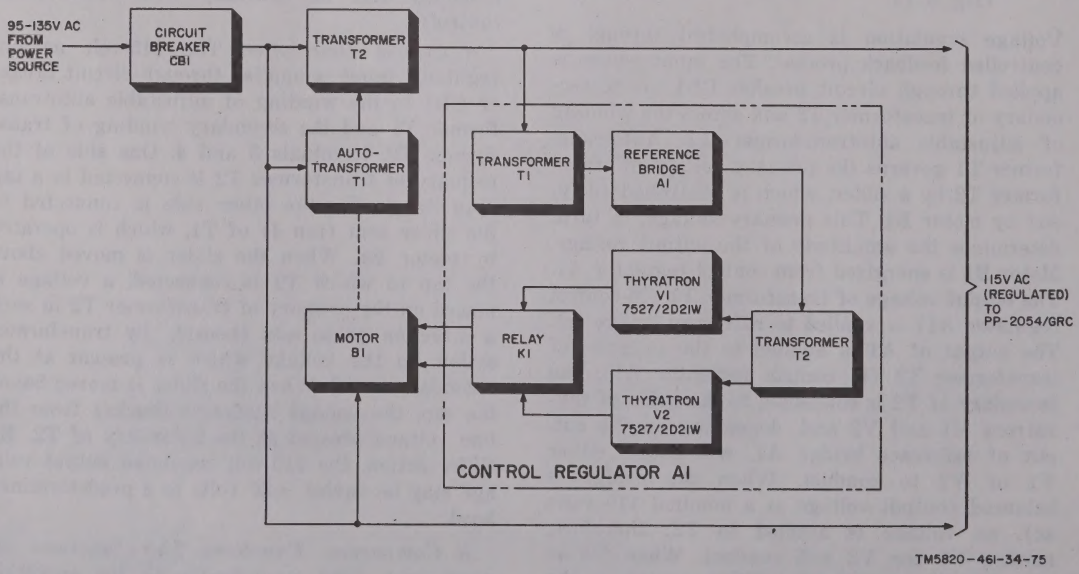


Figure 6-1. Voltage Regulator CN-514/GRC, block diagram.

V1 positive and cause the tube to conduct. When V1 conducts, current flows through the winding between terminals 2 and 3 of relay K1, causing contacts 4 and 6 to close and applying 115 volts ac to motor B1. When motor B1 operates, it moves the slider on adjustable transformer T1 to add voltage to the regulated 115-volt ac output line. When the regulated output line again reaches 115 volts ac, the bridge circuit is balanced and no voltage appears at the primary or secondary of T2; therefore, no error voltage is produced to fire the thyratrons.

(2) When the input voltage rises, the same series of events occur as for low voltage, except that V2 conducts to energize the winding between terminals 1 and 8 at K1 and operate motor B1 in the opposite direction; the slider of autotransformer T1 moves in such a direction as to lower the output voltage.

b. Component Functions. The functions of component parts associated with the operation of the regulator circuit, not described in *a* above, are listed in the chart below:

Component	Function
R1 and C1	Phase-shifting network for motor B1.
R2	Output voltage adjustment.
R1 and R4 (1A1)	V1 and V2 plate current-limiting resistors.
R6 and R7 (1A1)	V1 and V2 grid current-limiting resistors.
C9 and C7 (1A1)	Filter grid circuit of 1 and V2.
R8 (1A1)	Bias adjustment of tubes V1 and V2.
R9 and C8 (1A1)	Rc filter for bias resistor R8.
C3 and C4 (1A1)	K1 antichatter capacitors.
C1 and C2 (1A1)	Arc suppressors for K1 contacts.
CR1 and CR2	Part of voltage divider for tubes V1 and V2 bias.
L1 and C5 (1A1)	Noise filter for plate circuit of tube V1.
L2 and C6 (1A1)	Noise filter for plate circuit of tube V2.

CHAPTER 7

DIRECT SUPPORT MAINTENANCE

Section I. TROUBLESHOOTING AND REPAIRS

7-1. Scope of Direct Support Maintenance

Direct support maintenance personnel can perform procedures as follows:

a. Perform voltage and resistance measurements on the CN-514/GRC and regulator assembly 1A1 (para 7-4).

b. Perform resistance and continuity tests on relays, transformers, and unit wiring (para 7-5).

c. Isolate troubles to a component (chassis or panel-mounted components) (para 7-5).

d. Replace the components covered in *c* above (para 7-6).

e. Adjust the tension of the drive chain (para 7-7).

f. Adjust the output voltage and sensitivity (para 7-8).

7-2. Tools, Test Equipment, and Materials Required

The chart below lists the tools, test equipment, and other items required to troubleshoot and repair the equipment at direct support maintenance.

Item	Federal stock No.	Reference
Multimeter ME-26B/U	6625-542-6407	TM 11-6625-200-12.
Voltmeter, Meter ME-30A/U	6625-669-0742	TM 11-6625-320-12.
Multimeter TS-352B/U	6625-553-0142	TM 11-6625-366-15.
Tool Kit, Electronic Equipment TK-100/G	5180-605-0079	
Cable Assembly, Power Electrical CX-4559/U (4-1/2 ft) (for ac power connections).	5995-889-0849	
Cable Assembly, Power Electrical CX-4686/U (10 ft) (for connection to ac power source).	5995-889-0850	
Test leads (same as provided with TS-352B/U).		
Dummy load for CN-514/GRC.		

Fig. 7-1.

7-3. Localizing Troubles

a. General. The procedures outlined in the chart below can be used to locate troubles in the CN-514/GRC. Parts locations are shown in figures 7-2, 7-3, 7-6, and 7-7. When use of the troubleshooting chart isolates the trouble to a particular circuit, use the procedures given in paragraphs 7-4 and 7-5 to isolate the defective component.

b. Use of Chart. The troubleshooting chart (*c* below) supplements the procedures given in the organizational quarterly preventive maintenance checks and services chart (para 5-5) and the organizational troubleshooting chart (para 5-10). If previous operational checks have resulted in reference to a particular item of the chart, go directly to the referenced item. If no operational symptoms are known, begin with item 1 of the organizational quarterly preventive maintenance checks and services chart (para 5-5) and continue through the organizational troubleshooting chart (para 5-10) and the direct support troubleshooting chart (*c* below) until the trouble has been determined.

c. Troubleshooting Chart. Dynamic bench testing requires connection to a power source and a powerload. Use a 115-volt, 60-Hertz (Hz) source capable of supplying 5,500 volt-amperes, and connect the dummy load (fig. 7-1).

Item No.	Trouble symptom	Probable trouble	Checks and corrective measures
1	With POWER ON-OFF switch CB1 set to ON, POWER ON indicator DS2 does not light and no output voltage is available.	Defective CB1	Check continuity of CB1 (fig. 7–2).
2	With POWER ON-OFF switch CB1 set to ON, POWER ON indicator DS2 lights, but no output voltage is available.	Defective T2 secondary	Check continuity of T2 secondary (figs. 7–3 and 10–3).
3	With POWER ON-OFF switch CB1 set to ON, POWER ON indicator DS2 does not light, but unregulated output voltage is available.	Defective T1	Check continuity of T1 (figs. 7–3 and 10–3).
4	With MANUAL-AUTOMATIC switch S1 set to MANUAL, MANUAL indicator DS1 lights, but output voltage cannot be regulated; automatic operation normal.	Defective S1 or S2	Check S1 and S2 (fig. 7–2).
5	Output voltage cannot be regulated with MANUAL-AUTOMATIC switch S1 set to AUTOMATIC; manual operation is normal.	Defective components in regulator assembly 1A1.	Check continuity of 1A1T1 and resistance of 1A1T2 (para 7–4). Perform voltage and resistance measurements for 1A1V1 and 1A1V2 (fig. 7–5) and associated components (fig. 10–3).
6	Output voltage cannot be regulated with MANUAL-AUTOMATIC switch S1 set to either MANUAL or AUTOMATIC.	*a.* Defective B1	*a.* Remove regulator assembly 1A1 from main frame. Place MANUAL-AUTOMATIC switch S1 at AUTOMATIC. Check for proper field winding resistance (normally 500 ohms) by measuring between pins J11–4 and J11–6, and J11–4 and J11–7 (fig. 7–4).
		b. Defective T1 or T2 primary	*b.* Check resistance of T2 primary (para 7–4) and continuity of T1 (fig. 7–3).
7	Output voltage is adjusted to maximum or minimum as soon as MANUAL-AUTOMATIC switch is placed at AUTOMATIC. MANUAL operation is normal.	*a.* Incorrect adjustment of R2	*a.* Check adjustment of R2 (para 7–8).
		b. Defective R2	*b.* Check resistance (normally 8 to 100 ohms) of R2 (fig. 7–3).
		c. Defective 1A1T1	*c.* Check continuity of 1A1T1 primary and secondary (fig. 7–3 and 10–3).
8	Regulated voltage requires more than 1 second to correct to 115 volts from either 105 or 125 volts.	Excessive friction in variable autotransformer drive train.	Check drive chain adjustment (para 7–7). If chain is too tight, correction time will be lengthened. If chain is too loose, it may drag on bottom of case. Check sprockets and chain for dirt and rust. Check to see that T1 (fig. 7–3) rotates freely.
9	Regulated voltage overshoots more than three times or oscillates (hunts) continuously.	*a.* 1A1R8 incorrectly adjusted or defective (sensitivity control).	*a.* Check adjustment of 1A1R8 (para 7–8). Check for proper resistance (normally 0 to 10,000 ohms) of 1A1R8.

Item No.	Trouble symptom	Probable trouble	Checks and corrective measures
		b. Partial or complete loss of bias to V1 and V2, or defective bias network components.	b. Measure for proper forward (normally 10 ohms) and reverse (normally infinity) resistance of 1A1CR1 and 1A1CR2; check for resistance (normal 4,700 ohms) of 1A1R9; check for shorted 1A1C8 (fig. 7-7).
10	POWER ON-OFF switch trips when regulator tries to correct voltage.	Shorted components in motor drive circuit.	Check for shorted B1, C1, 1A1C1, or 1A1C2 (fig. 7-3, 7-7, and 10-3).
11	Regulated voltage corrects in only one direction.	a. Defective B1	a. Refer to item 6 above.
		b. Defective components in thyratron circuits.	b. Perform voltage and resistance measurement for V1 and V2 (fig. 7-5).
		c. Defective T2 and 1A1T2	c. Check resistance of T2 and 1A1T2 windings (para 7-4).
		d. Defective 1A1K1	d. Check resistance of 1A1K1 solenoids; resistance between terminals 1 and 8 and 2 and 3 (fig. 7-7 and 10-3) should be 6,000 ohms.
12	Insufficient range of output voltage adjustment.	Defective T1	Check for obstruction preventing full travel of T1 slider (fig. 7-3). Check T1 for shorted turns.
13	Regulator circuit drives T1, but output voltage remains constant.	Defective T1	Refer to item 12 above.
		Defective T2	Refer to item 11 above.

7-4. Voltage and Resistance Measurements

Normal voltages and resistances are given in figures 7-4 and 7-5. The indicated readings are measured with an ME-26B/U.

7-5. Dc Resistance of Coils and Transformers

Coils and transformers that have a resistance of 1 ohm, or greater, are listed in the chart below. Components (and transformer terminals) not listed have a resistance of less than 1 ohm. These components can be checked by continuity measurements, by visual inspection, or by substitution. Refer to figures 10-3 and 10-4, schematic and wiring diagrams, respectively, for continuity checks and circuit points.

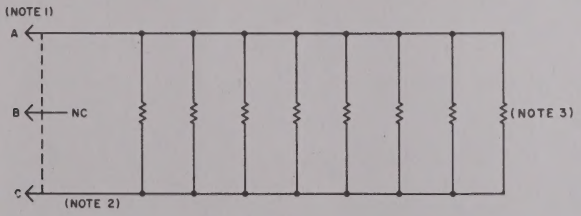
Transformers	Terminals	Ohms
T2	1-2	27
1A1T2	1-2	20
	3-4	1,060
	4-5	1,406

7-6. Parts Replacement

No special procedures are required for parts replacement at direct support maintenance. Refer to figures 7-2, 7-3, 7-6, and 7-7 for part locations.

NOTE

Later models of the CN-514/GRC use a larger gear on TI than is shown in figure 7-6.



NOTES:

1. USE A CONNECTOR, PLUG IDENTICAL TO THAT ON CX-4558/U.
2. USE NO. 8 AWG WIRE (18 IN.) BETWEEN CONNECTOR AND RESISTORS.
3. RESISTORS ARE 600-WATT EDISON BASE NICHROME WIRE HEATERS.

ELIDI001

Figure 7-1. Dummy load for CN-514/GRC.

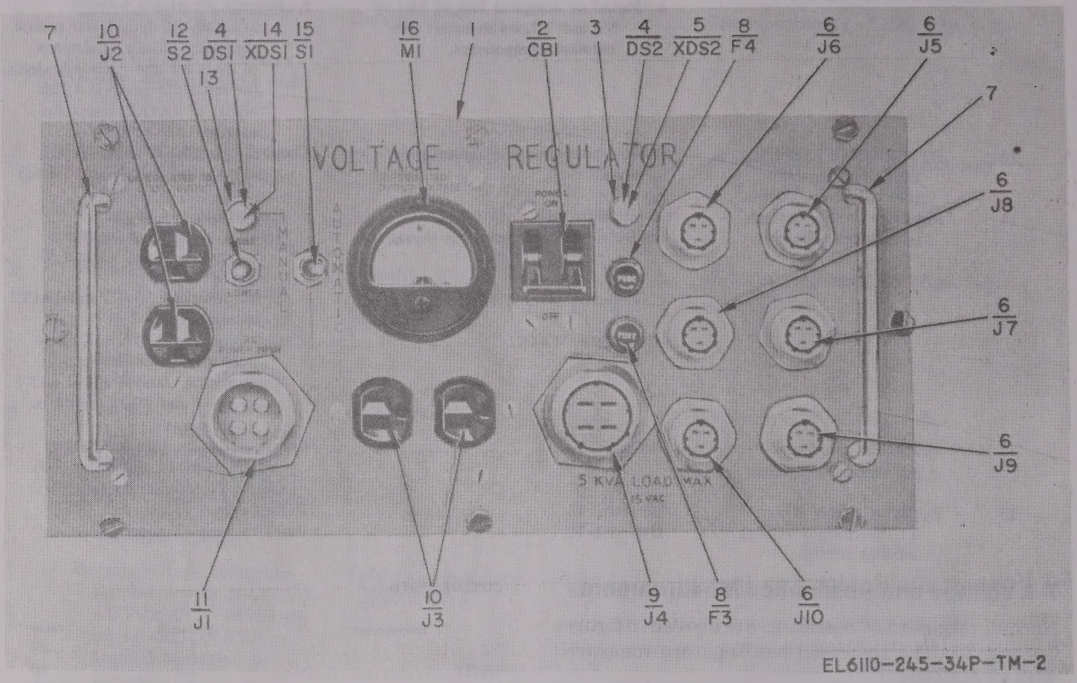


Figure 7-2. Voltage Regulator, CN-514/GRC front panel, parts location.

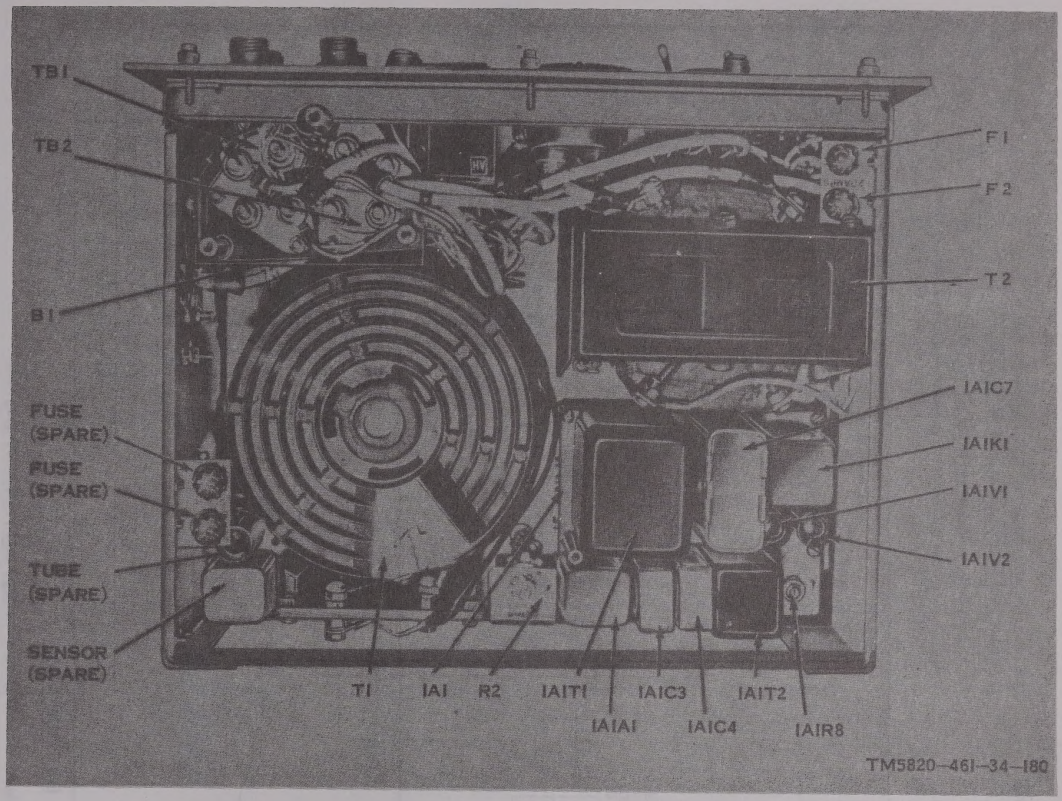
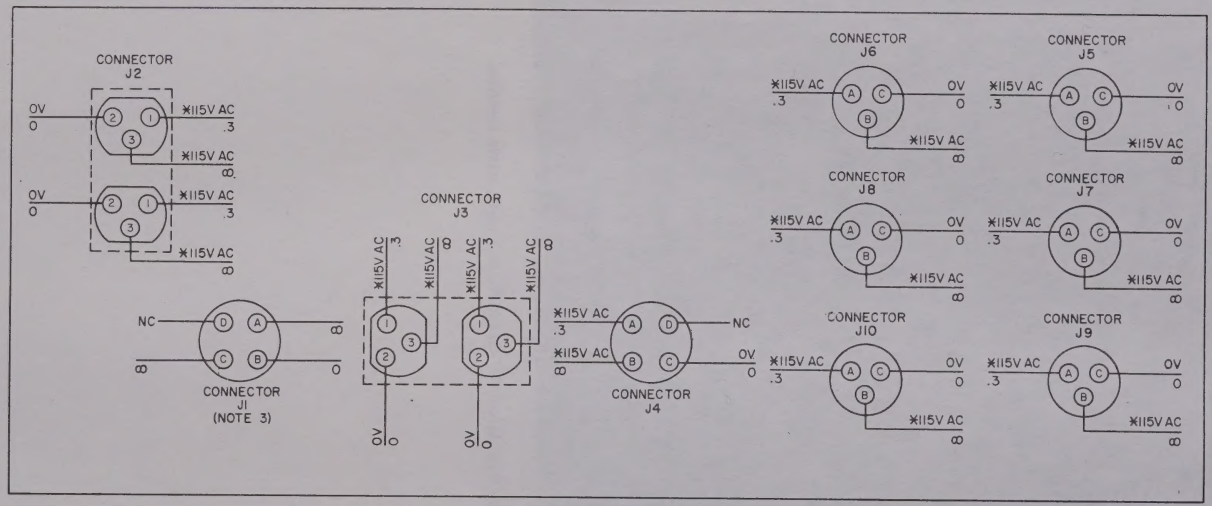


Figure 7-3. Voltage Regulator, CN-514/GRC top view, parts location.

NOTES:

1. VOLTAGE READINGS APPEAR ABOVE LINE. RESISTANCE READINGS APPEAR BELOW LINE.
2. UNLESS OTHERWISE SHOWN, VOLTAGES AND RESISTANCES ARE MEASURED WITH RESPECT TO J11, PIN 4 WITH THE UNIT CONNECTED TO THE FRAME.
3. ONLY RESISTANCE READINGS ARE TAKEN FOR THIS CONNECTOR.
4. VOLTAGE AND RESISTANCE READINGS FOR THIS CONNECTOR ARE TAKEN WITH CONTROL REGULATOR A1 REMOVED.
5. * INDICATES MEASUREMENT TAKEN BETWEEN PINS.
6. [MANUAL/AUTOMATIC] SWITCH SET TO [MANUAL].
7. [AC POWER] CIRCUIT BREAKER SET TO [ON].
8. ALL VOLTAGE AND RESISTANCE READINGS ARE TAKEN WITH AN ME-26/U.



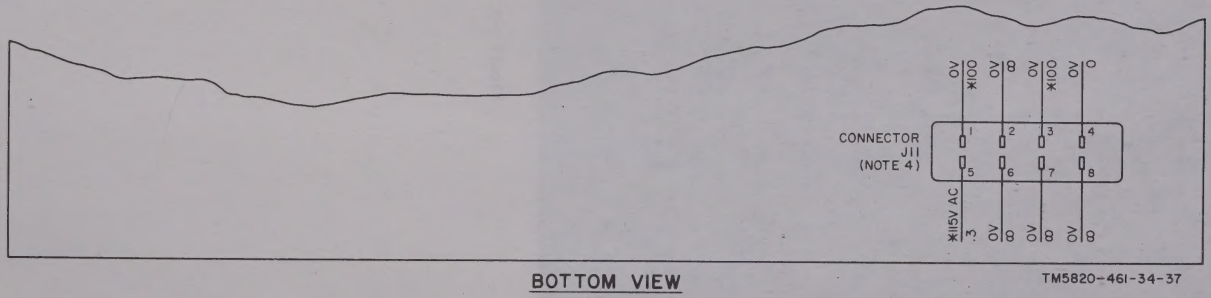


Figure 7-4. Voltage Regulator CN-514/GRC voltage and resistance diagram.

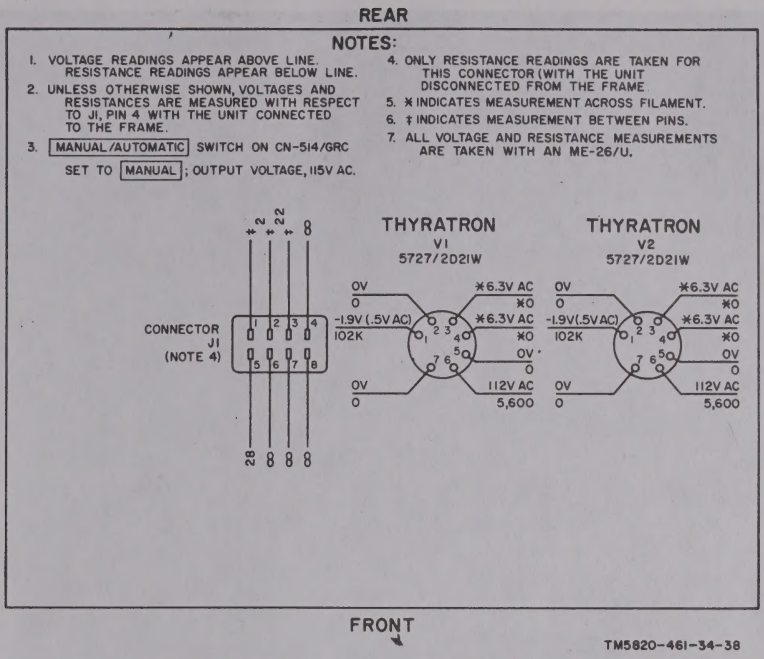

REAR
NOTES:
1. VOLTAGE READINGS APPEAR ABOVE LINE. RESISTANCE READINGS APPEAR BELOW LINE.
2. UNLESS OTHERWISE SHOWN, VOLTAGES AND RESISTANCES ARE MEASURED WITH RESPECT TO J1, PIN 4 WITH THE UNIT CONNECTED TO THE FRAME.
3. MANUAL/AUTOMATIC SWITCH ON CN-514/GRC SET TO MANUAL; OUTPUT VOLTAGE, 115V AC.
4. ONLY RESISTANCE READINGS ARE TAKEN FOR THIS CONNECTOR (WITH THE UNIT DISCONNECTED FROM THE FRAME.
5. * INDICATES MEASUREMENT ACROSS FILAMENT.
6. ‡ INDICATES MEASUREMENT BETWEEN PINS.
7. ALL VOLTAGE AND RESISTANCE MEASUREMENTS ARE TAKEN WITH AN ME-26/U.
CONNECTOR J1 (NOTE 4)
THYRATRON V1 5727/2D21W
THYRATRON V2 5727/2D21W
OV
0
-1.9V (.5V AC)
102K
*6.3V AC
*0
OV
0
112V AC
5,600
FRONT
TM5820-461-34-38

Figure 7–5. Regulator Assembly 1A1, voltage and resistance diagram.

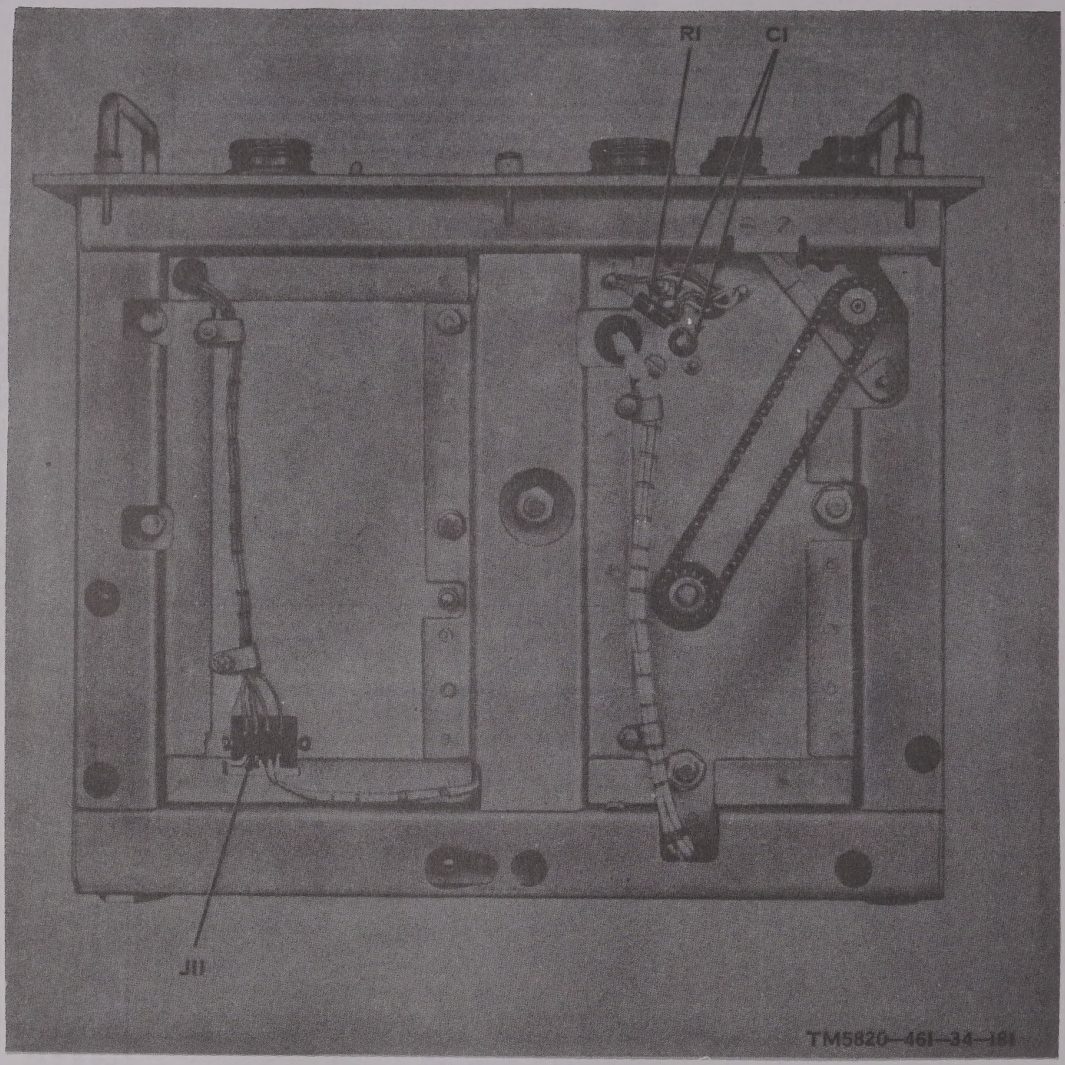


Figure 7-6. Voltage Regulator CN-514/GRC, bottom view, parts location.

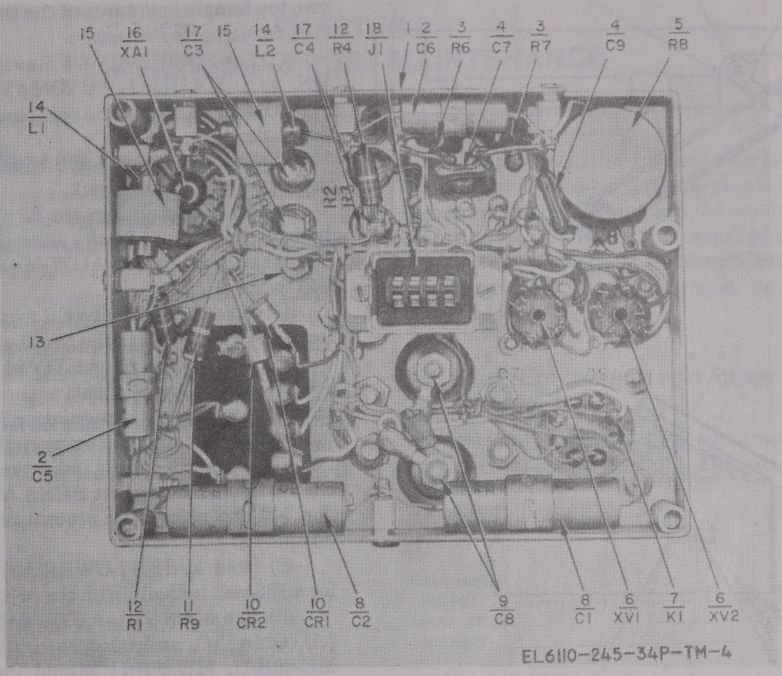


Figure 7-7. Regulator Assembly 1A1, bottom view, parts location.

Section III. ADJUSTMENTS

7-7. Drive Cha. i Adjustments

(fig. 7-8)

Adjust the drive chain by performing the procedures given in *a* through *j* below.

a. Loosen the nut (A).

b. Loosen the screw (B) in the terminal shield (C).

c. Loosen the hexagonal stud (D) on the terminal board with a small, 3/8-inch, open-end wrench.

d. Loosen the hexagonal stud (F) located in the rectangular hole (E).

e. Loosen the drive chain by squeezing the chain in the middle between the index finger and the thumb.

f. Tighten the drive chain by prying the lever (G) away from the chassis edge (H) with a large screwdriver. The drive chain is properly adjusted when approximately three-eights of an inch play is in one side.

g. Tighten the hexagonal stud (F).

h. Tighten the nut (A).

i. Tighten the hexagonal stud (D).

j. Tighten the screw (B).

7-8. Output Voltage and Sensitivity Adjustments

To perform the adjustment of output voltage control R2 (*c*(1), (2), and (3) below) and sensitivity controls 1A1R8 (*c*(1) through (11) below), connect the CN-514/GRC to an ac power source and a dummy load.

a. Equipment Required.

(1) Multimeter ME-26B/U.

(2) Cable Assembly, Power, Electrical CX-4686/U (10 ft) (to connect the CN-514/GRC to the ac power source).

(3) A dummy load, made from 600-watt, Edison base, nichrome wire heaters (eight) (fig. 7-1), to provide a load for the CN-514/GRC.

(4) An ac power source capable of providing 5,500 volt-amperes at 115 volts, 50 to 60 Hz.

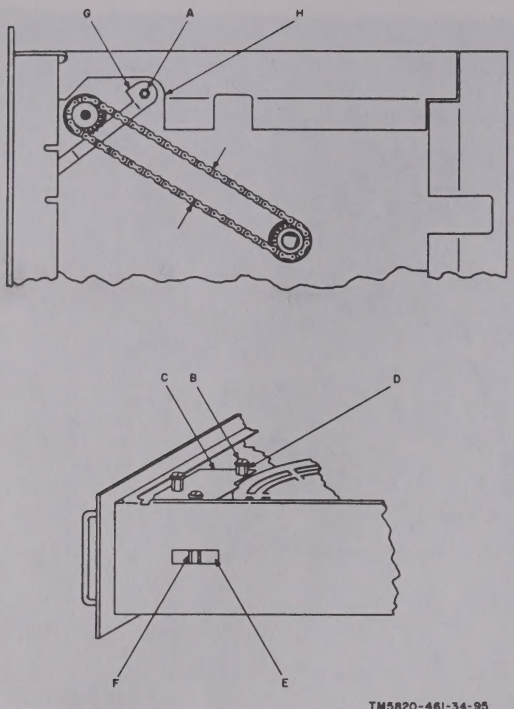


Figure 7-8. Drive chain adjustment.

b. Test Setup.

(1) Connect AC POWER INPUT connector J1 (fig. 7-2) to the ac power source; use the CX-4686/U.

(2) Connect the dummy load to one of output connectors J5 through J9; make the connection to the two top female apertures of the three-pin receptacle.

c. Adjustment Procedure.

(1) Set POWER ON-OFF switch CB1 (fig. 7-2) to ON and MANUAL-AUTOMATIC switch S1 to AUTOMATIC. Allow the equipment to warm-up for 5 minutes.

(2) Connect the ME-26B/U, adjusted to measure ac, across the dummy load.

(3) Adjust potentiometer R2 (fig. 7-3) to obtain an indication of 115 ± 1.2 volts ac on the ME-26B/U.

(4) Set MANUAL-AUTOMATIC switch S1 (fig. 7-2) to MANUAL.

(5) Hold RAISE-LOWER switch S2 at LOWER until the ME-26B/U indicates 95 volts.

(6) Set MANUAL-AUTOMATIC switch S1 to AUTOMATIC, and observe the ME-26B/U; ME-26B/U should indicate regulation from 95 to 115 ± 1.2 volts without overshooting more than three times.

(7) If the ME-26B/U indication overshoots more than three times, adjust SENS ADJ control 1A1R8 (fig. 7-3) and repeat the procedures given in (5) and (6) above.

(8) Hold RAISE-LOWER switch S2 at RAISE for a 135-volt indication on the ME-26B/U.

(9) Set MANUAL-AUTOMATIC switch S1 to AUTOMATIC, and observe the indication on the ME-26B/U. ME-26B/U should indicate regulation from 135 to 115 ± 1.2 volts without overshooting more than three times.

(10) If the ME-26B/U indicates more than three overshoots, readjust R8 and repeat the procedures given in (8) and (9) above.

(11) Repeat the procedures given in (1) through (10) above until any further adjustment of 1A1R8 does not cause any improvement.

CHAPTER 8
GENERAL SUPPORT MAINTENANCE

8-1. Scope of General Support Maintenance

a. Testing procedures are prepared for use by Electronics Field Maintenance Shops and Service Organizations responsible for general support maintenance of electronic equipment to determine the acceptability of repaired electronics equipment. These procedures set forth specific requirements that repaired equipment *must* meet before it is returned to the using organization. The testing procedures may also be used as a guide for testing equipment that has been repaired at direct support if the proper tools and test equipment are available. A summary of the performance standards is given in paragraph 8-6.

b. Comply with the instructions preceding each chart before proceeding to the chart. Perform each test in sequence. *Do not vary the sequence.* For each step, perform all the actions required in the *Control settings* columns; then perform each specific test procedure and verify it against its performance standard.

8-2. Test Equipment and other Equipment Required

The test equipment and other equipment required to perform the testing procedures given in this chapter are listed below.

a. Test Equipment.

Nomenclature	*Federal stock No.*	*Technical manual*
Multimeter ME-26B/U	6625-542-6407	TM 11-6625-200-15.
Voltmeter, Meter ME-30A/U	6625-669-0742	TM 11-6625-320-12.
Variable Power Transformer TF-171/USM	5950-503-0632	

b. Other Equipment. Eight (8) Nichrome wire heaters, 600-watt (Edison base, or equivalent).

8-3. Test Conditions and Requirements

a. General. All tests are conducted with the equipment connected as shown in figure 8-1.

b. Test Equipment Models. Specific models of test equipment are used to perform the test procedures given in paragraph 8-5. If these test procedures are performed with other models of the test equipment, an allowance must be made for any test connection or test results that may differ from those given in the test procedures.

c. Modification Work Orders. No modification work orders (MWO) are in effect for this equipment as of the date of this publication. MWO's pertaining to this equipment that are published after the date of this publication will be listed in DA Pam 310-7. Nonapplication of MWO's other than those classified URGENT should not be reason for rejection.

8-4. Physical Tests and Inspection

a. Test Equipment and Materials. None.

b. Test Connections and Conditions. Remove the CN-514/GRC from its case.

c. Procedure.

Step No.	Test equipment	Control Settings / Equipment under test	Test procedure	Performance standard
1	None.	Controls may be in any position	a. Inspect all controls and mechanical assemblies for loose or missing screws, bolts, or nuts.	a. No loose or missing parts; screws, nuts, d bolts are tight.
			b. Inspect subassemblies and their cases for physical damage and condition of finish.	b. No physical damage (bends, cracks, splits, etc.) evident. Painted surfaces do not show barel metal. Panel lettering legible.
			NOTE Touchup painting is recommended whenever practicable. Screwheads, receptacles, connectors, and other plated parts will not be painted or polished with abrasives.	
			c. Inspect all connectors, plugs, receptacles, and meter and dial faceplate for looseness and damage.	c. All plugs and connectors are tight. All receptacles are tight and free from damage. Meter and dial faceplate are secure and not split or cracked.
			d. Remove fuseholder caps; inspect fuseholder for damage and fuses for correct type and rating.	d. Fuseholders are in serviceable condition. Each fuseholder contains a good fuse of proper type and rating, as indicated on panel.
	None.	Set controls as indicated in *test procedure* column.	Operate each of the following front panel switches: MANUAL-AUTOMATIC RAISE-LOWER POWER ON-OFF	Switches operate freely without binding or excessive looseness.

8-5. Operational and Output Voltage Tests

(fig. 8-1)

a. Test Equipment and Materials.
(1) Multimeter ME-26B/U.
(2) Voltmeter, Meter ME-30A/U.
(3) Variable Power Transformer TF-171/USM.
(4) Eight (8) Nichrome wire heaters, 600-watt (Edison base, or equivalent).
b. Test Connections and Conditions. Connect the equipment as shown in figure 8-1.
c. Procedure.

Step No.	Test equipment	Control Settings / Equipment under test	Test procedure	Performance standard
1	None.	POWER ON-OFF: OFF. MANUAL-AUTOMATIC: MANUAL.	a. Set POWER ON-OFF switch to ON.	a. POWER ON indicator lights.
			b. Hold RAISE-LOWER switch in position required to adjust output to 115 volts ac.	b. MANUAL indicator lights when RAISE-LOWER switch is in either position. REGULATED OUTPUT VOLTAGE meter indicates 115 volts (red mark on meter scale).

Step No.	Test equipment	Control Settings: Equipment under test	Test procedure	Performance standard
			c. Hold RAISE-LOWER switch to drop voltage below 115 volts ac. Set MANUAL-AUTOMATIC switch to AUTOMATIC.	c. REGULATED OUTPUT VOLTAGE meter indication drops and then corrects automatically to 115 vac.
2	*TF–171/USM:* Knob indicates 0 on dial. *ME–30A/U:* Range selector switch: 300. Power switch: On. *ME–26B/U:* SELECTOR: AC. RANGE: 300V.	MANUAL-AUTOMATIC: AUTOMATIC. POWER ON-OFF: ON.	a. Adjust variable transformer knob for 115-volt indication on ME–30A/U.	a. ME–26B/U indicates 115 ±1.2 volts.
			b. Adjust TF–171/USM transformer knob for 95–volt indication on ME–30A/U.	b. ME–26B/U indicates 115 ±1.2 volts.
			c. Adjust TF–171/USM knob for 135–volt indication on ME–30A/U.	c. ME–26B/U indicates 115 ±1.2 volts.
3	Same as step 2 except Nichrome wire heaters disconnected.	Same as step 2, except: MANUAL-AUTOMATIC: MANUAL.	a. Adjust TF–171/USM knob for 115–volt indication on ME–30A/U.	a. None.
			b. Adjust CN–514/GRC RAISE-LOWER switch for 135–volt indication on ME–26B/U. Operate CN–514/GRC MANUAL-AUTOMATIC switch to AUTOMATIC.	b. ME–26B/U indicates regulation from 135 to 115 ±1.2 volts, with no more than 3 overshoots.
			c. On CN–514/GRC, operate MANUAL-AUTOMATIC switch to MANUAL; adjust RAISE-LOWER control for 95–volt indication on ME–26B/U. Operate MANUAL-AUTOMATIC switch to AUTOMATIC.	c. ME–26B/U indicates regulation from 95 to 115 ±1.2 volts, with no more than 3 overshoots.

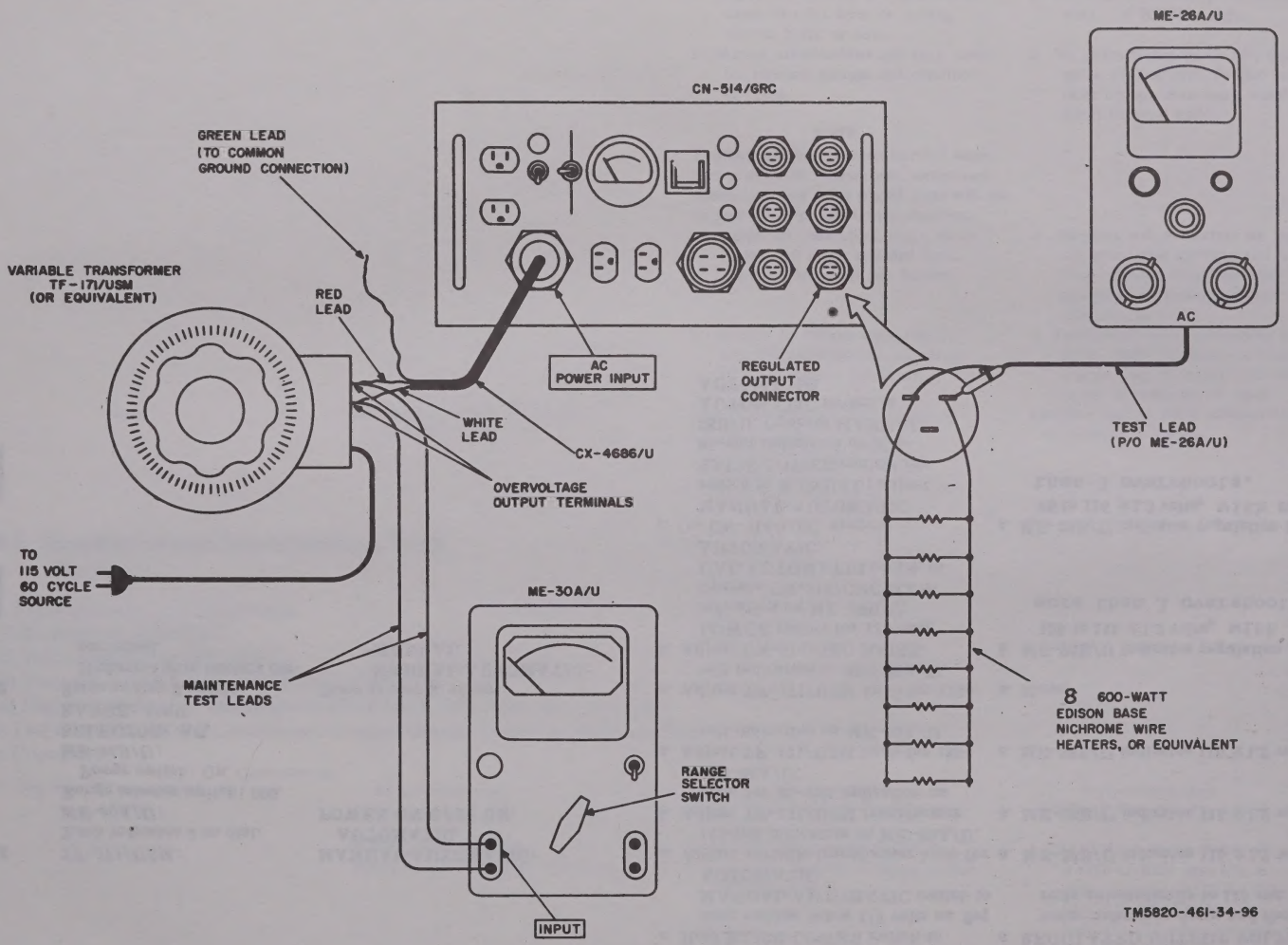


Figure 8-1. Output voltage test setup.

8–6. Summary of Test Data

Personnel may find it convenient to arrange data in a manner similar to that shown below:

Regulation:	Performance standard
115–volt ac input (automatic regulation).	115 ±1.2 volts ac.
95–volt ac input (automatic regulation).	115 ±1.2 volts ac.
135–volt ac input (automatic regulation).	115 ±1.2 volts ac.
95 to 135–volt ac input.	Corrects to 115 ±1.2 volts ac under automatic regulation with no more than 3 overshoots.

CHAPTER 9
DEPOT OVERHAUL STANDARDS

9-1. Applicability of Depot Overhaul Standards

a. The test outlined in this chapter measure the performance capability of a repaired equipment. Equipment that is to be returned to stock should meet the standards given in these tests.

b. Applicable procedures for the depots performing these tests and the general standards for repaired electronic equipment given in TB SIG 355-1, TB SIG 355-2, and TB SIG 355-3 form a part of the requirements for testing this equipment.

9-2. Performance Tests — Depot Overhaul Standard

The procedures in *d* below check the performance of various circuits in the CN-514/GRC.

a. Equipment Required

Item	*References*
Test Set, Power Supply AN/GRM-67*.	TM 11-6625-661-12, -50
Test Facilities Kit MK-715/GRC-50(V) from which the following item is required; Fan, Axial HD-709/GRC-50(V) (fan).	(Para, 7-4; fig. 7-1)*
Cable Assembly, Power, Electrical CX-4559/U (4 ft, 6 in.) (part of AN/GRC-50 (*) (V)) (3 cables required).	TM 11-5820-461-12
Ac power extension cord with 3-prong female receptacle to accept plug of HD 700/GRC-50 (V).	
Nichrome wire heaters, 600 watts, (3 required, Edison base, or equivalent).	Fig. 9-2.

*Refer to TM 11-6625-661-50 for circuits of the TS-2126/GRM-67 associated with tests of the CN-514/GRC.

b. Physical Tests and Inspection. Perform the operations given in paragraph 8-4.

c. Test Setup. Refer to figure 9-1 for test connections.

(1) Set the variac voltage control to zero (0 volt), and connect the variac to an ac power source that is protected with at least a 40-ampere fuse or circuit breaker.

(2) On the CN-514-GRC, set the POWER switch to OFF, and the AUTOMATIC — MANUAL switch to AUTOMATIC.

(3) On the TS-2126-GRM-67, set the switches as follows:

(a) AC POWER switch to OFF.

(b) LOAD SELECT switches, LOAD 1, LOAD 2, and LOAD 3, to OFF.

(c) Fabricated LOAD 4 switch to OFF.

(4) Remove the chassis of the CN-514/GRC from its case, and connect the CN-514/GRC to the TS-2125/GRM-67. The three CX-4559/U cables can be connected to any three receptacles on the CN-514/GRC; all six receptacles are parallel. Connect LOAD 4 to one of the other three.

(5) Connect simulated load A1 to the TS-2126/GRM-67. Attach the fan to A1, and connect an extension cable from the fan to the ac power source. The fan should operate.

d. Procedure. Inspect the CN-514/GRC to see that all cables and the tube shield are in place. Check the fuses for proper amperage ratings: 1 ampere at 250 volts and 20 amperes at 125 volts.

NOTE

For a CN-514/GRC that is not provided with MANUAL — AUTOMATIC and RAISE — LOWER switches (operating an automatic control only), use all test procedures except those that involve these switches.

CAUTIONS

1. Do not connect simulated load A1 to the TS-2126/GRM-67 unless the fan is connected to the ac power source and is attached to A1.
2. Do not turn on or test the CN-514/GRC unless simulated load A1 is connected to the TS-2126/GRM-67.

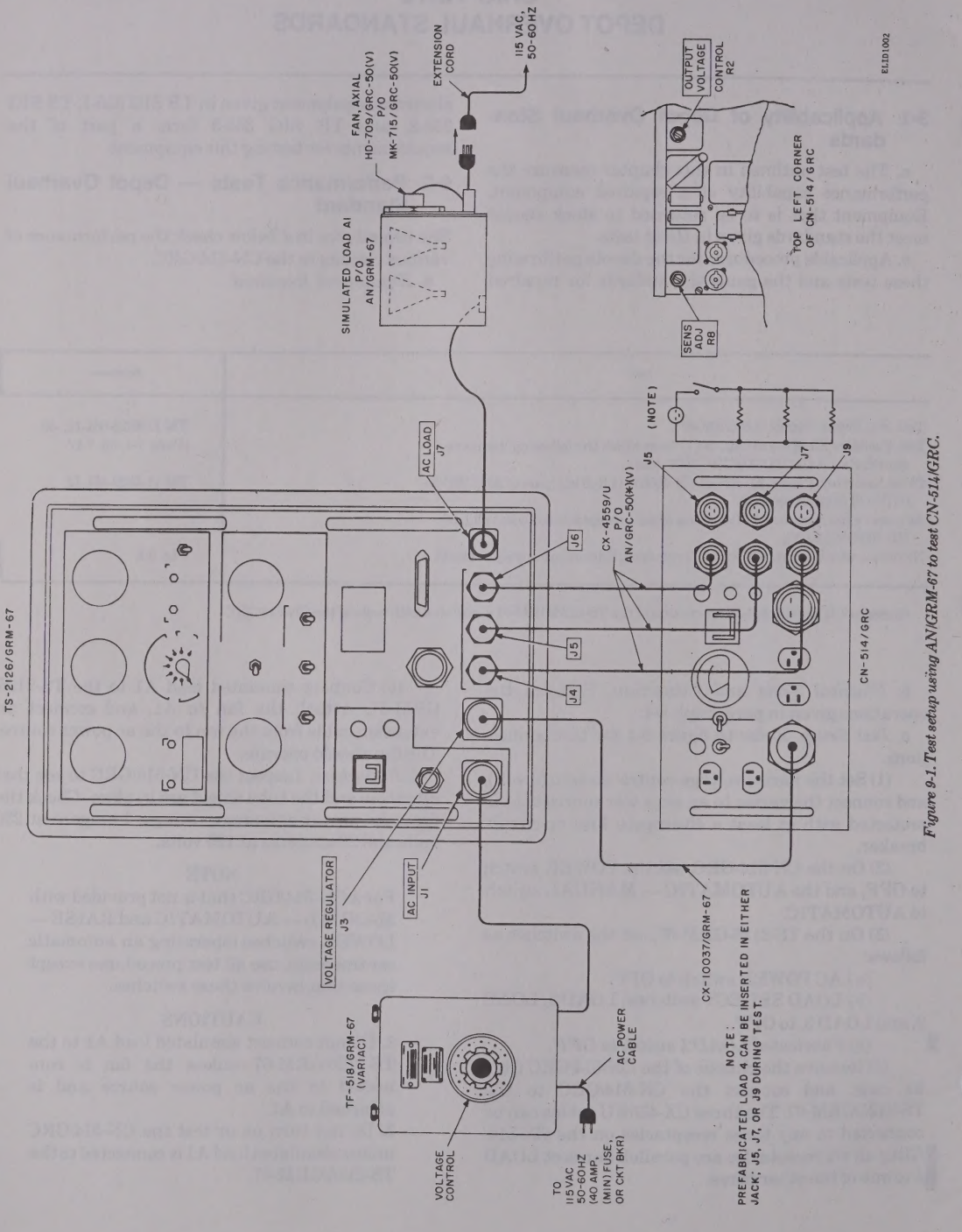
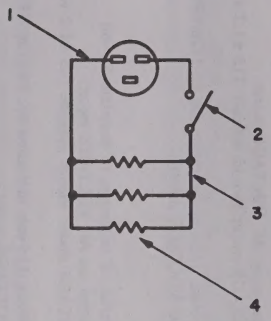


Figure 9-1. Test setup using AN/GRM-67 to test CN-514/GRC.

Step No.	Item	Control	Position	Action or Indication
			PREPARATION	
1	Variac	Voltage control	Set to 115 (volts).	AC ON indicator (red) illuminates.
	TS-2126/GRM-67	AC POWER	ON	Power ON indicator (green) illuminates.
	CN-514/GRC	POWER switch	ON	Allow the equipment to warm up for 5 minutes before proceeding.
			ADJUSTMENT OF R2 AND R8	
2	TS-2126/GRM-67 . .	AC VOLTAGE SELECT switch.	AC VOLTAGE INPUT	Adjust variac voltage control to obtain 115-volt indication on AC VOLTAGE meter.
			REGULATOR VOLTAGE OUTPUT	On top of CN-514/GRC, adjust OUTPUT VOLTAGE control R5 to obtain 115-volt indication on AC VOLTAGE meter.
3	CN-514/GRC	MANUAL–AUTOMATIC switch.	MANUAL	MANUAL indicator illuminates.
		RAISE–LOWER switch	RAISE	Hold in RAISE position until TS-2126/GRM-67 AC VOLTAGE meter indicates 135 volts. CN-514/GRC REGULATED OUTPUT VOLTAGE meter should indicate ±3% of 135 volts.
4	CN-514/GRC	MANUAL–AUTOMATIC switch.	AUTOMATIC	Observe rotation of revolving heat radiator on top of CN-514/GRC; it should not overshoot a position and return more than three times (sometimes it vibrates and then stops). REGULATED OUTPUT VOLTAGE meter should indicate 115 volts ±3%. If heat radiator overshoots its position more than three times before it stops, adjust SENS ADJ control R8 (on top of CN-514/GRC) slightly, and repeat procedures in steps 3 and 4 until heat radiator settles in position with no more than three overshoots.
5	CN-514/GRC	MANUAL–AUTOMATIC switch.	MANUAL.	
		RAISE–LOWER switch	RAISE	Hold in position until TS-2126/GRM-67 AC VOLTAGE meter indicates 135 volts.
		MANUAL–AUTOMATIC switch	AUTOMATIC	Heat radiator should return to position with no more than three overshoots. 115-volt indication is obtained on TS-2126/GRM-67 AC VOLTAGE meter and ±3 volt indication on CN-514/GRC REGULATED OUTPUT VOLTAGE meter.
6	CN-514/GRC	MANUAL–AUTOMATIC switch.	MANUAL.	
		RAISE–LOWER switch	LOWER	Hold in LOWER position until heat radiator stops rotating.
		MANUAL–AUTOMATIC switch.	AUTOMATIC	Heat radiator should rotate back to position with no more than three overshoots. AC VOLTAGE and REGULATED OUTPUT VOLTAGE meter indications are same as in step 5 above.

Step No.	Item	Control	Position	Action or indication
		LOAD TESTS, AUTOMATIC OPERATION		
7	TS-2126/GRM-67	AC VOLTAGE SELECT	AC VOLTAGE INPUT	Adjust variac to obtain 95-volt indication on AC VOLTAGE meter.
			REGULATOR VOLTAGE OUTPUT.	AC VOLTAGE meter should indicate 115 volts ± 1.2.
8	TS-2126/GRM-67	LOAD SELECT switches LOAD 1, and LOAD 4.	ON.	
		AC VOLTAGE SELECT switch.	AC VOLTAGE INPUT	Adjust variac, if necessary, to maintain 95-volt indication on AC VOLTAGE meter.
			REGULATOR VOLTAGE OUTPUT.	AC VOLTAGE meter should indicate 115 ± 1.2 volts.
9	TS-2126/GRM-67	LOAD SELECT switches LOAD 2, and LOAD 4.	ON.	
		AC VOLTAGE SELECT switch.	AC VOLTAGE INPUT	Adjust variac, if necessary, to maintain 95-volt indication on AC VOLTAGE meter.
			REGULATOR VOLTAGE OUTPUT.	AC VOLTAGE meter should indicate 115 ± 1.2 volts.
10	TS-2126/GRM-67	LOAD SELECT switches LOAD 3, and LOAD 4.	ON.	
		AC VOLTAGE SELECT switch.	AC VOLTAGE INPUT	Adjust variac, if necessary, to maintain 95-volt indication on AC VOLTAGE meter.
			REGULATOR OUTPUT VOLTAGE.	AC VOLTAGE meter should indicate 115 ± 1.2 volts.
11	TS-2126/GRM-67	LOAD SELECT switches LOAD 1, LOAD 2, LOAD 3, and LOAD 4.	OFF.	
		AC VOLTAGE SELECT switch.	AC VOLTAGE INPUT.	
		LOAD SELECT switches LOAD 1, and LOAD 4.	ON	Adjust variac to obtain 135-volt indication on AC VOLTAGE meter.
		AC VOLTAGE SELECT switch.	REGULATOR OUTPUT VOLTAGE.	AC VOLTAGE meter should indicate 115 ± 1.2 volts.
12	TS-2126/GRM-67	LOAD SELECT switches LOAD 2, and LOAD 4.	ON.	
		AC VOLTAGE SELECT switch.	AC VOLTAGE INPUT	Adjust variac, if necessary, to maintain 135-volt indication on AC VOLTAGE meter.
			REGULATOR OUTPUT VOLTAGE.	AC VOLTAGE meter should indicate 115 ± 1.2 volts.
13	TS-2126/GRM-67	LOAD SELECT switches LOAD 3, and LOAD 4.	ON.	
		AC VOLTAGE SELECT switch.	AC VOLTAGE INPUT	Adjust variac, if necessary, to maintain 135-volt indication on AC VOLTAGE meter.
			REGULATOR OUTPUT VOLTAGE.	AC VOLTAGE meter should indicate 115 ± 1.2 volts.
		LOAD SELECT switches LOAD 1, LOAD 2, LOAD 3, and LOAD 4.	OFF.	
		LOAD TESTS, MANUAL OPERATION; 95-VOLT INPUT		
14	TS-2126/GRM-67	AC VOLTAGE SELEET	AC VOLTAGE INPUT . . . . . switch.	Adjust variac to obtain 95-volt indication on AC VOLTAGE meter.

Step No.	Item	Control	Position	Action or indication
15	CN-514/GRC	MANUAL–AUTOMATIC switch.	MANUAL.	
		RAISE–LOWER switch	RAISE	Hold in RAISE position until TS-2126/GRM-67 AC VOLTAGE meter indicates 115 volts.
16	TS-2126/GRM-67	LOAD SELECT switches LOAD 1, and LOAD 4.	ON.	
		AC VOLTAGE SELECT switch.	AC VOLTAGE INPUT	Adjust variac, if necessary, to maintain 95-volt indication on AC VOLTAGE meter.
			REGULATOR VOLTAGE OUTPUT.	AC VOLTAGE meter should indicate 115 ±1.2 volts.
17	CN-514/GRC	RAISE–LOWER switch		Set to obtain 115-volt indication on TS-2126&GRM-67 AC VOLTAGE meter.
18	TS-2126/GRM-67	LOAD SELECT switches LOAD 2, and LOAD 4.	ON.	
		AC VOLTAGE SELECT switch.	AC VOLTAGE INPUT	Adjust variac, if necessary, to maintain 95-volt indication on AC VOLTAGE meter.
			REGULATOR VOLTAGE OUTPUT.	AC VOLTAGE meter should indicate 115 ±1.2 volts.
19	CN-514/GRC	RAISE–LOWER switch		Set to obtain 115-volt indication on TS-2126/GRM-67 AC VOLTAGE meter.
20	TS-2126/GRM-67	LOAD SELECT switches LOAD 3, and LOAD 4.	ON.	
		AC VOLTAGE SELECT switch.	AC VOLTAGE INPUT	Adjust variac, if necessary, to maintain 95-volt indication on AC VOLTAGE meter.
			REGULATOR VOLTAGE OUTPUT.	AC VOLTAGE meter should indicate 115 ±1.2 volts.
21	CN-514/GRC	RAISE–LOWER switch		Set to obtain 115-volt indication on TS-2126/GRM-67 AC VOLTAGE meter.
22	TS-2126/GRM-67	LOAD SELECT switches LOAD 1, LOAD 2, LOAD 3, and LOAD 4.	OFF.	



LEGEND

1. CABLE ASSEMBLY, POWER, ELECTRICAL, CX-4559/U OR EQUIVALENT.
2. AC ON/OFF POWER SWITCH.
3. WIRE NO.12 AWG.
4. NICHROME WIRE HEATERS, 600 WATTS, (3 REQUIRED, EDISON BASE OR EQUIVALENT).

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Figure 9-2. Test LOAD 4 fabrication.

Step No.	Item	Control	Position	Action or indication
		LOAD TESTS, MANUAL OPERATION: 135-VOLT INPUT		
23	TS-2126/GRM-67	AC VOLTAGE SELECT switch.	AC VOLTAGE INPUT	Adjust variac to obtain 135-volt indication on AC VOLTAGE meter.
24	CN-514/GRC	RAISE-LOWER switch.	LOWER	Hold in LOWER position until TS-2126/GRM-67 AC VOLTAGE meter indicates 115 volts.
25	TS-2126/GRM-67	LOAD SELECT switches LOAD 1, and LOAD 4.	ON.	
		AC VOLTAGE SELECT switch.	AC VOLTAGE INPUT	Adjust variac, if necessary, to maintain 135-volt indication on AC VOLTAGE meter.
			REGULATOR OUTPUT VOLTAGE.	AC VOLTAGE meter should indicate 115 ± 1.2 volts.
26	CN-514/GRC	RAISE–LOWER switch		Set to obtain 115-volt indication on TS-2126/GRM-67 AC VOLTAGE meter.
27	TS-2126/GRM-67	LOAD SELECT switches LOAD 2, and LOAD 4.	ON.	
		AD VOLTAGE SELECT switch.	AC VOLTAGE INPUT	Adjust variac, if necessary, to maintain 135-volt indication on AC VOLTAGE meter.
			REGULATOR VOLTAGE OUTPUT.	AC VOLTAGE meter should indicate 115 volts.
28	CN-514/GRC	RAISE–LOWER switch		Set to obtain 115-volt indication on TS-2126/GRM-67 AC VOLTAGE meter.
29	TS-2126/GRM-67	LOAD SELECT switches LOAD 3, and LOAD 4.	ON.	
		AC VOLTAGE SEEECT switch.	AC VOLTAGE INPUT	Adjust variac, if necessary, to maintain 135-volt indication on AC VOLTAGE meter.
			REGULATOR OUTPUT VOLTAGE	AC VOLTAGE meter should indicate 115 ±1.2 volts.
30	CN-514/GRC	RAISE–LOWER switch		Set to obtain 115-volt indication on TS-2126/GRM-67 AC VOLTAGE meter.
31	TS-2126/GRM-67	LOAD SELECT switches LOAD 1, LOAD 2, LOAD 3, and LOAD 4.	OFF.	
			OUTPUT VOLTAGES ADJUSTMENTS	
32	TS-2126/GRM-67	AC VOLTAGE SELECT switch.	AC VOLTAGE INPUT	Adjust variac to obtain 115-volt indication on AC VOLTAGE meter.
			REGULATED VOLTAGE OUTPUT.	
33	CB-514/GRC	MANUAL–AUTOMATIC switch.	AUTOMATIC.	
		OUTPUT VOLTAGE control R2 (top of chassis).	. . . . .	Adjust for *minimum* indication on TS-2126/GRM-67 AC VOLTAGE and CN-514/GRC meters. Meters should indicate below 110 volts.
34	TS-2126/GRM-67	LOAD SELECT switches LOAD 1, and LOAD 4.	ON.	

Step No.	Item	Control	Position	Action or indication
		AC VOLTAGE SELECT switch.	AC VOLTAGE INPUT	Adjust variac, if necessary, to maintain 115-volt indication on AC VOLTAGE meter.
			REGULATED VOLTAGE OUTPUT.	AC VOLTAGE and CN-514/GRC meters should indicate below 110 volts.
35	TS-2126/GRM-67	LOAD SELECT switches LOAD 2, and LOAD 4.	ON.	
		AC VOLTAGE SELECT switch.	AC VOLTAGE INPUT	Adjust variac, if necessary, to maintain 115-volt indication on AC VOLTAGE meter.
			REGULATED VOLTAGE OUTPUT.	AC VOLTAGE and CN-514/GRC meters should indicate below 110 volts.
36	TS-2126/GRM-67	LOAD SELECT switches LOAD 3, and LOAD 4.	ON.	
		AC VOLTAGE SELECT switch.	AC VOLTAGE INPUT	Adjust variac, if necessary, to maintain 115-volt indication on AC VOLTAGE meter.
			REGULATED VOLTAGE OUTPUT.	AC VOLTAGE and CN-514/GRC meters should indicate below 110 volts.
37	TS-2126/GRM-67	LOAD SELECT switches LOAD 1, LOAD 2, LOAD 3, and LOAD 4.	OFF.	
38	CN-514/GRC	OUTPUT VOLTAGE control R2.	. . . . .	Adjust for 130-volt indication on AC VOLTAGE and CN-514/GRC meters.
39	TS-2126/GRM-67	LOAD SELECT switches LOAD 1, and LOAD 4.	ON.	
		AC VOLTAGE SELECT switch.	AC VOLTAGE INPUT	Adjust variac, if necessary, to maintain 115-volt indication on AC VOLTAGE meter.
			REGULATED VOLTAGE OUTPUT.	AC VOLTAGE and CN-514/GRC meters should indicate above 120 volts.
40	TS-2126/GRM-67	LOAD SELECT switches LOAD 2, and LOAD 4.	ON.	
		AC VOLTAGE SELECT switch.	AC VOLTAGE INPUT	Adjust variac, if necessary, to maintain 115-volt indication on AC VOLTAGE meter.
			REGULATED VOLTAGE OUTPUT.	AC VOLTAGE and CN-514/GRC meters should indicate above 120 volts.
41	TS-2126/GRM-67	LOAD SELECT switches LOAD 3, and LOAD 4.	ON.	
		AC VOLTAGE SELECT switch.	AC VOLTAGE INPUT	Adjust variac, if necessary, to maintain 115-volt indication on AC VOLTAGE meter.
			REGULATED VOLTAGE OUTPUT.	AC VOLTAGE and CN-514/GRC meters should indicate above 120 volts.
42	TS-2126/GRM-67	LOAD SELECT switches LOAD 1, LOAD 2,	OFF.	

Step No.	Item	Control	Position	Action or indication
		LOAD 3 and LOAD 4.		
		AC VOLTAGE SELECT switch.	AC VOLTAGE INPUT	Adjust variac, if necessary, to obtain 115-volt indication on CN-514/GRC meter.
			REGULATED VOLTAGE OUTPUT.	AC VOLTAGE and CN-514/GRC meters should indicate above 120 volts.
43	CN-514/GRC	OUTPUT VOLTAGE control R2.		Adjust to obtain 115-volt indication on TS-2126/GRM-67 AC VOLTAGE meter.
		POWER switch	OFF	POWER ON indicator extinguishes.
44	TS-2126/GRM-67	AC POWER switch	OFF	AC ON indicator extinguishes. Disconnect cables from CN-514/GRC connectors, and replace CN-514/GRC chassis in its case.
				If no further tests are to be made, allow fan to cool resistor elements in simulated load A1 for approximately 5 minutes after the TS-2126/GR-67 is turned off; then disconnect extension cord from fan. Set variac voltage control to zero (0 volt).

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CHAPTER 10

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

10–1. Disassembly of Equipment

a. The instructions given in *b* below are recommended as a guide for preparing the CN–514/GRC for shipment and limited storage.

b. Disconnect the unit as follows:

(1) Disconnect the power cable from the AC POWER INPUT connector (para 2–4).

(2) Disconnect the cabling from UNREGULATED 115 V UTILITY OUTPUT connectors.

(3) Disconnect the cabling from regulated output voltage connectors.

10–2. Repackaging

Repackaging of equipment for shipment or limited storage normally will be performed at a packaging facility or by a repackaging team. If emergency packaging is required, select the materials from those listed in SB 38–100. Package the equipment in accordance with the original packaging insofar as possible with the available materials.

Section II. DEMOLITION TO PREVENT ENEMY USE

10–3. Authority for Demolition

Demolition of the equipment will be accomplished only upon order of the commander. Use the destruction procedures outlined in paragraph 10–4 to prevent further use of the equipment.

10–4. Methods of Destruction

The tactical situation and time available will determine the method to be used when destruction of the equipment is ordered. In most cases, it is preferable to completely demolish some portions of the equipment rather than partially destroy all the equipment units.

a. Smash. Smash the controls, resistors, capacitors, switches, and other interior parts; use sledges, hammers, axes, machetes, crowbars, or other heavy tools.

b. Cut. Cut the cords, cables, and wiring; use axes, handaxes, or machetes.

***Warning:* Be extremely careful with explosive and incendiary devices. Use these items only when the need is urgent.**

c. Burn. Burn the cords, wiring, manuals, and components; use gasoline, kerosene, oil, flamethrowers, or incendiary grenades.

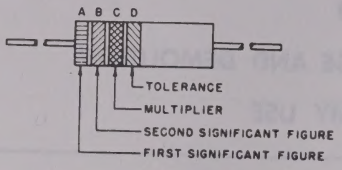
d. Bend. Bend the panels, casings, and connectors.

e. Explosives. If explosives are necessary, use firearms, grenades, or TNT.

f. Disposal. Burn or scatter the destroyed parts in slit trenches, foxholes, or other holes, or throw them into nearby streams.

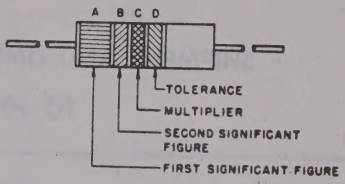
COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS

COMPOSITION-TYPE RESISTORS



BAND A— Equal Width Band Signifies Composition-Type

WIREWOUND-TYPE RESISTORS

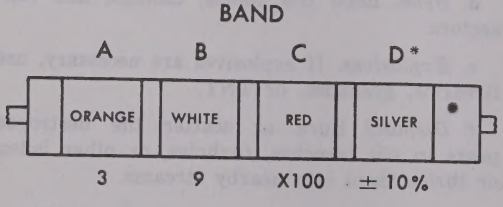


BAND A— Double Width Signifies Wire-wound Resistor

COLOR CODE TABLE

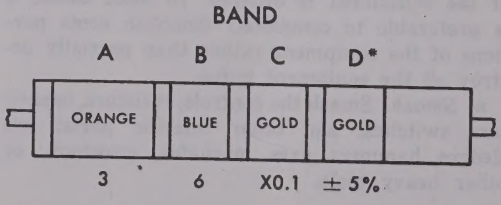
BAND A		BAND B		BAND C		BAND D*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1		
BROWN	1	BROWN	1	BROWN	10		
RED	2	RED	2	RED	100		
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	± 10
GREEN	5	GREEN	5	GREEN	100,000	GOLD	± 5
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	SILVER	0.01		
WHITE	9	WHITE	9	GOLD	0.1		

EXAMPLES OF COLOR CODING



NOMINAL RESISTANCE 3,900 Ohms

RESISTANCE TOLERANCE ± 10 percent



3.6 Ohms

± 5 percent

*If Band D is omitted, the resistor tolerance is ±20%, and the resistor is not Mil-Std.

STD-R2

Figure 10-1. Color code marking for MIL-STD resistors.

APPENDIX A

REFERENCES

Following is a list of applicable references available to the operator, organizational, direct support, general support, and depot maintenance personnel of Voltage Regulator CN-514/GRC.

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	U. S. Army Equipment Index of Modification Work Orders.
SB 38-100	Preservation, Packaging, and marking Materials, Supplies, and Equipment Used by the Army.
TA 11-17	Signal Field Maintenance Shops.
TA 11-100 (11-17)	Allowances of Signal Corps Expendable Supplies for Signal Field Maintenance Shops.
TB SIG 355-1	Depot Inspection Standard for Repaired Signal Equipment.
TB SIG 355-2	Depot Inspection Standard for Refinishing Repaired Signal Equipment.
TB SIG 355-3	Depot Inspection Standard for Moisture and Fungi Resistant Treatment.
TB SIG 364	Field Instructions for Painting and Preserving Electronics Command Equipment.
TM 9-213	Painting Instructions for Field Use.
TM 11-6625-200-15	Operator, Organizational, DS, GS, and Depot Maintenance Manual: Multimeters ME-26A/U, ME-26B/U, ME-26C/U, and ME-26D/U.
TM 11-6625-203-12	Operator and Organizational Maintenance Manual: Multimeter AN/URM-105, Including Multimeter ME-77/U.
TM 11-6625-320-12	Operator and Organizational Maintenance Manual: Voltmeter, Meter ME-30A/U and Voltmeters, Electronic ME-30B/U, and ME-30C/U, and ME-30E/U.
TM 11-6625-366-15	Organizational, DS, GS, and Depot Maintenance Manual: Multimeter TS-352B/U.
TM 38-750	Army Equipment Record Procedures.

APPENDIX B

BASIC ISSUE ITEMS

DELETED

APPENDIX C

MAINTENANCE ALLOCATION

Section I. INTRODUCTION

C-1. General

This appendix provides a summary of the maintenance operations covered in the equipment literature for Voltage Regulator CN-514/GRC. It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

C-2. Explanation of Format for Maintenance Allocation Chart

a. Group Number. Not used.

b. Component Assembly Nomenclature. This column lists the item names of components units, assemblies, subassemblies, and modules on which maintenance is authorized.

c. Maintenance Function. This column indicates the maintenance category at which performance of the specific maintenance function is authorized. Authorization to perform a function at any category also includes authorization to perform that function at higher categories. The codes used represent the various maintenance categories as follows:

Code	Maintenance Category
C	Operator/Crew
O	Organizational Maintenance
F	Direct Support Maintenance
H	General Support Maintenance
D	Depot Maintenance

d. Tools and Equipment. The numbers appearing in this column refer to specific tools and equipment which are identified by these numbers in section III.

e. Remarks. Self explanatory.

C-3. Explanation of Format for Tool and Test Equipment Requirements

The columns in the tool and test equipment requirements chart are as follows:

a. Tools and Equipment. The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool for the maintenance function.

b. Maintenance Category. The codes in this column indicate the maintenance category normally allocated the facility.

c. Nomenclature. This column lists tools, test, and maintenance equipment required to perform the maintenance functions.

d. Federal Stock Number. This column lists the Federal stock number.

e. Tool Number. Not used.

MAINTENANCE ALLOCATION CHART

GROUP NUMBER	COMPONENT ASSEMBLY NOMENCLATURE	MAINTENANCE FUNCTIONS											TOOLS AND EQUIPMENT	REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
	VOLTAGE REGULATOR CN-514/GRC	C		C										Exterior only
		O		O									8	Interior only
			C											Operational tests
			O										1, 7	Tests required to locate faulty regulator assembly 1A1A1; input & output voltages, electron tubes
			F										2, 3, 5, 7	General testing
			H										2, 3, 4, 5, 7	All tests
			D										2, 3, 4, 5, 6	All tests
					C									Operator controls
					F								5, 9	Output voltage
										O			8	Replaces: fuses, knobs, cable assembly, and regulator sub-assembly, electron tubes
										F			9	All repairs
										H				
										D				
											H		2, 3, 4, 5, 6, 9	Shop support
												D	2, 3, 4, 5, 6, 9	Shop support

SECTION III. TOOL AND TEST EQUIPMENT REQUIREMENTS

TOOL AND TEST EQUIPMENT REQUIREMENTS

TOOLS AND EQUIPMENT	MAINTENANCE CATEGORY	NOMENCLATURE	FEDERAL STOCK NUMBER	TOOL NUMBER
		CN-514/GRC (cont)		
1	O	MULTIMETER AN/URM-105	6625-581-2036	
2	F,H,D	MULTIMETER TS-352B/U	6625-242-5023	
3	F,H,D	MULTIMETER ME-26A/U	6625-646-9409	
4	H,D	TRANSFORMER, VARIABLE POWER TF-171/USM	5950-503-0632	
5	F,H,D	VOLTMETER, METER ME-30/G	6625-669-0742	
6	D	TEST SET, ELECTRON TUBE TV-2/U	6625-532-4167	
7	O,F,H	TEST SET, ELECTRON TUBE TV-7D/U	6625-820-0064	
8	O	TOOL KIT, RADIO REPAIRMAN TK-101/G	5180-064-5178	
9	F,H,D	TOOL KIT, ELECTRONIC EQUIPMENT TK-100/G	5180-605-0079	

INDEX

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Initial	2-3, 3-3	2-3, 3-1
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Sensitivity	7-8	7-9
Adjustments and repairs	5-11	5-4
Applicability, depot overhaul standards	9-1	9-1
Authority, demolition	10-3	10-1
Block diagram description	6-2	6-1
Chain linkage, maintenance	5-6*a*	5-2
Characteristics, technical	1-5	1-1
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Troubleshooting	4-7, 5-10, 7-3*c*	4-2, 5-3, 7-1
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Depot overhaul standards:		
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Unpacking information	2-1	2-1
Visual inspection	4-6, 5-9	4-2, 5-3
Voltage and resistance measurements	7-4	7-3

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)DE TABLES

CHARACTERISTIC[2]				DC WORKING VOLTAGE	OPERATING TEMP. RANGE	VIBRATION GRADE
CM	CN	CY	CB	CM	CM	CM
	A				−55° to +70°C	10–55 cps
B	E		B			
C		C			−55° to +85°C	
D			D	300		
E					−55° to +125°C	10–2,000 cps
F				500		
					−55° to +150°C	

ABLE III – For use with Group III, Temperature Compensating, Style CC

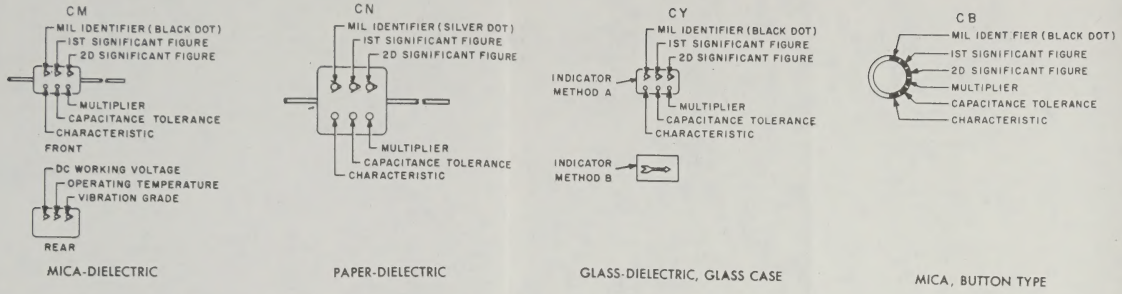
COLOR	TEMPERATURE COEFFICIENT[4]	1st SIG FIG	2nd SIG FIG	MULT PLIER[1]	CAPACITANCE TOLERANCE		MIL ID
					Capacitances over 10uuf	Capacitances 10uuf or less	
BLACK	0	0	0	1		± 2.0uuf	CC
BROWN	−30	1	1	10	± 1%		
RED	−80	2	2	100	± 2%	± 0.25uuf	
ORANGE	−150	3	3	1,000			
YELLOW	−220	4	4				
GREEN	−330	5	5		± 5%	± 0.5uuf	
BLUE	−470	6	6				
PURPLE (VIOLET)	−750	7	7				
GREY		8	8	0.01			
WHITE		9	9	0.1	± 10%		
GOLD	+100					± 1.0uuf	
SILVER							

to obtain the capacitance in uuf.

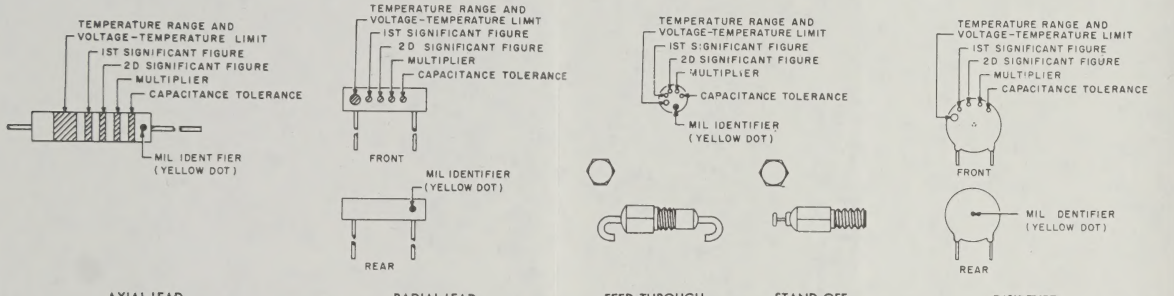
MIL–C–91, MIL–C–11272 and MIL–C–10950 respectively.

MIL–C–11015.

GROUP I Capacitors, Fixed, Various-Dielectrics, Styles CM, CN, CY, and CB



GROUP II Capacitors, Fixed Ceramic-Dielectric (General Purpose) Style CK



GROUP III Capacitors, Fixed, Ceramic-Dieletric (Temperature Compensating) Style CC

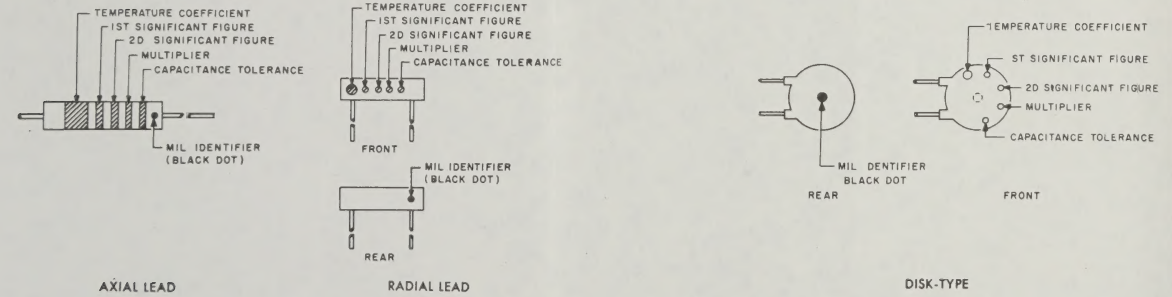


Figure 10–2. Color code marking for MIL-STD capacitors.

COLOR CODE TABLES

TABLE I – For use with Group I, Styles CM, CN, CY and CB

COLOR	MIL ID	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE				CHARACTERISTIC[2]				DC WORKING VOLTAGE	OPERATING TEMP. RANGE	VIBRATION GRADE
					CM	CN	CY	CB	CM	CN	CY	CB	CM	CM	CM
BLACK	CM, CY CB	0	0	1			± 20%	± 20%		A				−55° to +70°C	10–55 cps
BROWN		1	1	10					B	E		B			
RED		2	2	100	± 2%		± 2%	± 2%	C		C			−55° to +85°C	
ORANGE		3	3	1,000		± 30%			D			D	300		
YELLOW		4	4	10,000					E					−55° to +125°C	10–2,000 cps
GREEN		5	5		± 5%				F				500		
BLUE		6	6											−55° to +150°C	
PURPLE (VIOLET)		7	7												
GREY		8	8												
WHITE		9	9												
GOLD				0.1			± 5%	± 5%							
SILVER	CN				± 10%	± 10%	± 0%	± 10%							

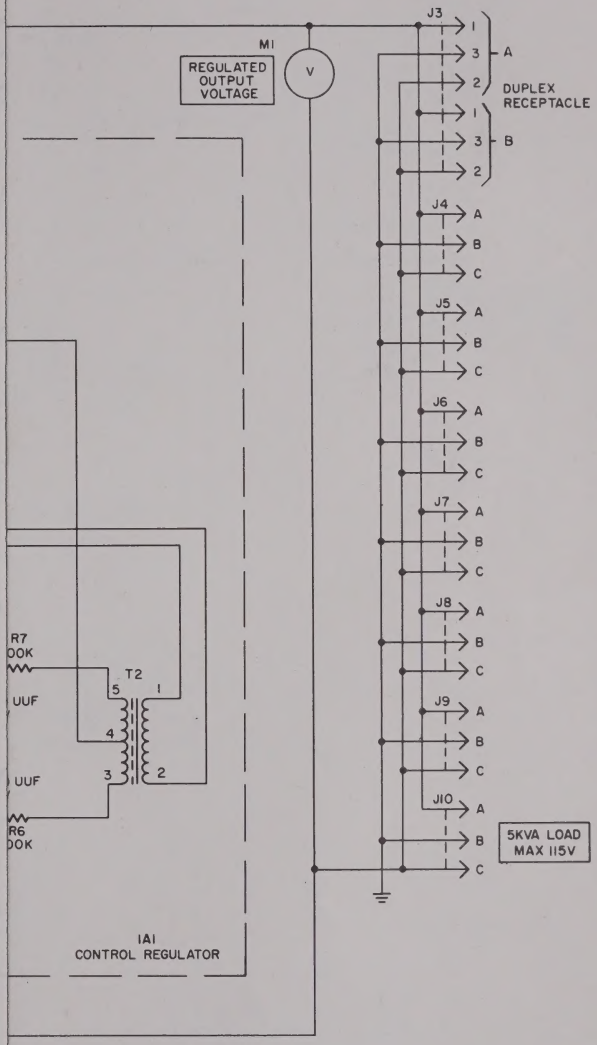
TABLE II – For use with Group II, General Purpose, Style CK

COLOR	TEMP. RANGE AND VOLTAGE – TEMP. LIMITS[3]	1st SIG FIG	2nd SIG FIG	MULT PLIER[1]	CAPACITANCE TOLERANCE	MIL 'D
BLACK		0	0	1	± 20%	
BROWN	AW	1	1	10	± 10%	
RED	AX	2	2	100		
ORANGE	BX	3	3	1,000		
YELLOW	AV	4	4	10 000		CK
GREEN	CZ	5	5			
BLUE	BV	6	6			
PURPLE (V OLET		7	7			
GREY		8	8			
WHITE		9	9			
GOLD						
SILVER						

TABLE III – For use with Group III, Temperature Compensating, Style CC

COLOR	TEMPERATURE COEFFICIENT[4]	1st SIG FIG	2nd SIG FIG	MULT PLIER[1]	CAPACITANCE TOLERANCE		MIL ID
					Capacitances over 10uuf	Capacitances 10uuf or less	
BLACK	0	0	0	1		± 2.0uuf	CC
BROWN	−30	1	1	10	± 1%		
RED	−80	2	2	100	± 2%	± 0.25uuf	
ORANGE	−150	3	3	1,000			
YELLOW	−220	4	4				
GREEN	−330	5	5		± 5%	± 0.5uuf	
BLUE	−470	6	6				
PURPLE (VIOLET)	−750	7	7				
GREY		8	8	0.01			
WHITE		9	9	0.1	± 10%		
GOLD	+100					± 1.0uuf	
SILVER							

1. The multiplier is the number by which the two significant (SIG) figures are multiplied to obtain the capacitance in uuf.
2. Letters indicate the Characteristics designated in applicable specifications: MIL–C–5, MIL–C–91, MIL–C–11272 and MIL–C–10950 respectively.
3. Letters indicate the temperature range and voltage-temperature limits designated in MIL–C–11015.
4. Temperature coefficient in parts per million per degree centigrade.

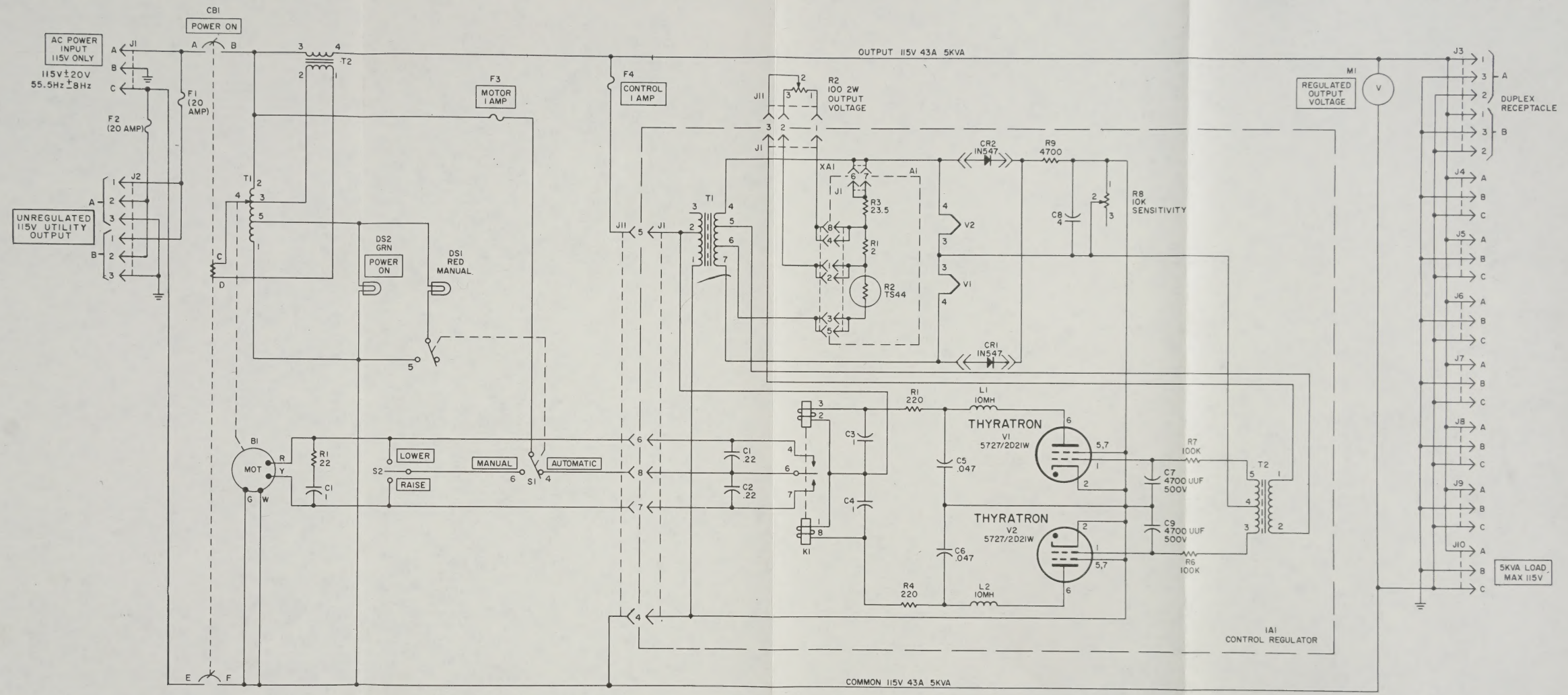


NOTES:

DICATES FRONT PANEL MARKING.

SS OTHERWISE INDICATED, RESISTANCES
N OHMS, CAPACITANCES ARE UF.

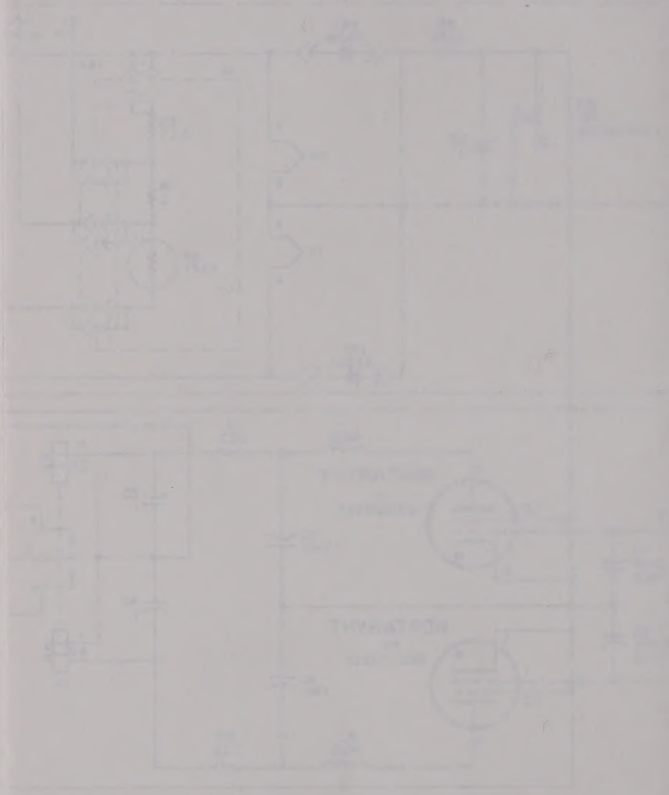
EL6110-245-15-CI-TM-1

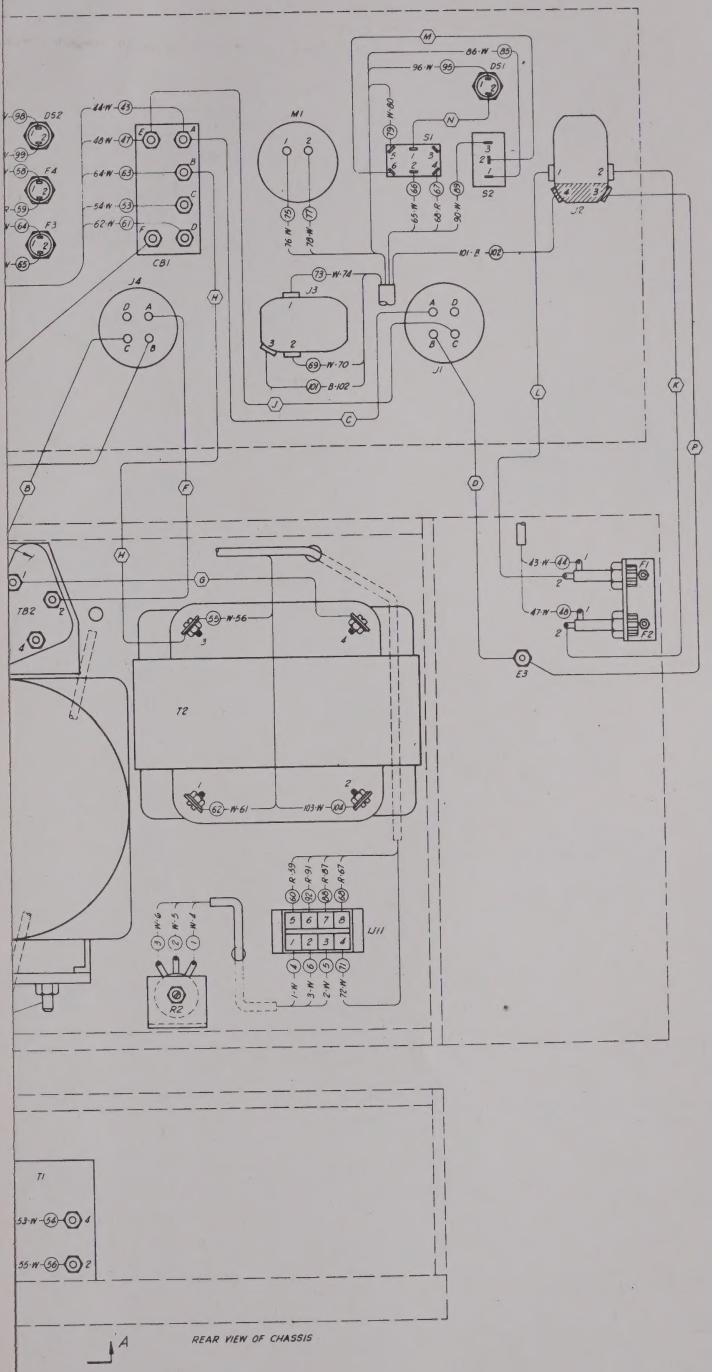


NOTES:
1. ▭ INDICATES FRONT PANEL MARKING.
2. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE UF.

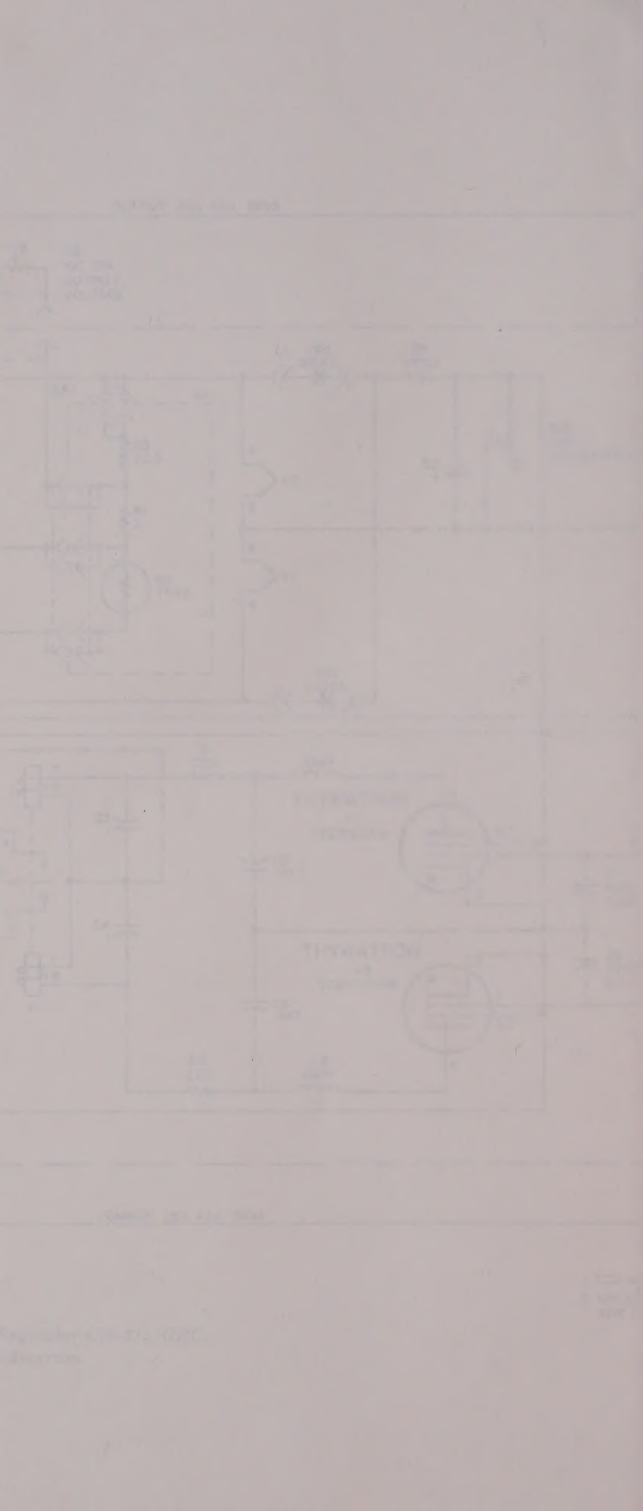
Figure 10-3. Voltage Regulator CN-514/GRC, schematic diagram.

EL6110-245-15- CI-TM-1





7-514/GRC, wiring diagram.



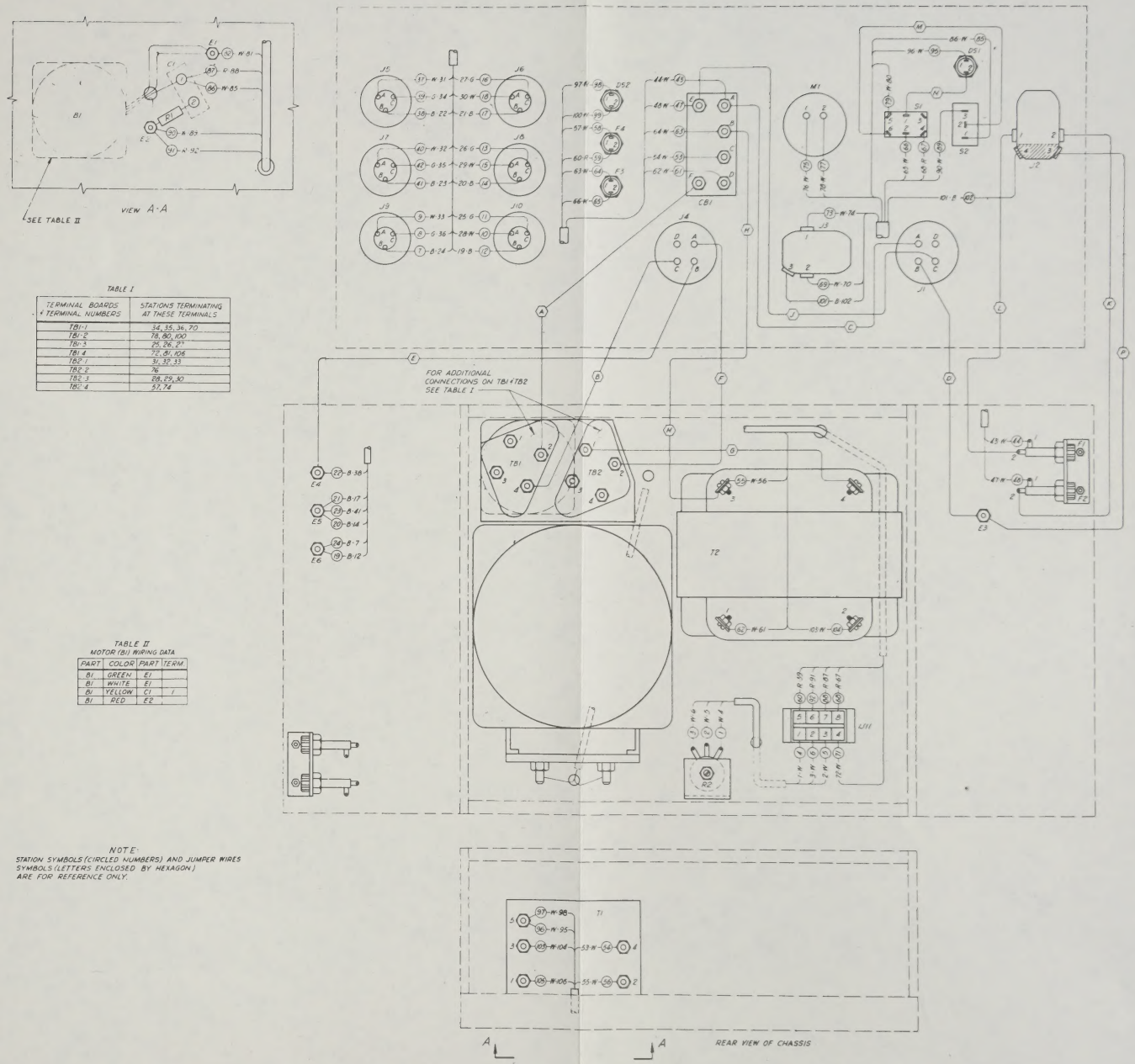


TABLE I

TERMINAL BOARDS & TERMINAL NUMBERS	STATIONS TERMINATING AT THESE TERMINALS
TB1-1	34, 35, 36, 70
TB1-2	78, 80, 100
TB1-3	25, 26, 27
TB1-4	72, 81, 106
TB2-1	31, 32, 33
TB2-2	76
TB2-3	28, 29, 30
TB2-4	57, 74

TABLE II
MOTOR (B1) WIRING DATA

PART	COLOR	PART	TERM
B1	GREEN	E1	
B1	WHITE	E1	
B1	YELLOW	C1	1
B1	RED	E2	

NOTE:
STATION SYMBOLS (CIRCLED NUMBERS) AND JUMPER WIRES SYMBOLS (LETTERS ENCLOSED BY HEXAGON) ARE FOR REFERENCE ONLY.

Figure 10-4. Voltage Regulator CN-514/GRC, wiring diagram.

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